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ABSTRACT

Based on observations in many schools, this report discusses the integration of vocational and academic education and describes various approaches to integration. In the first section, the various reasons supporting an integrated curriculum are examined. In the second section, eight different models of integration are outlined, and descriptions of how high schools have changed their curricula and restructured their program and course offerings are provided. Each of the models includes a variety of practices and approaches. The third section clarifies the requirements for successful efforts at integration, indicating the importance of consistency among the many groups that affect the schools. This section also outlines what resources are most crucial, and it addresses the need for sustained effort and the institutionalization of reform. The fourth section summarizes the purposes for and the ambitions of different approaches, from improving basic skills instruction within vocational courses to developing career paths to help students think about the consequences of their educational choices. The final part of this section explains how integration can reform the U.S. high school, with benefits for all students. Appendixes list: (1) schools visited and interviews conducted; and (2) curriculum materials related to the integration of vocational and academic education. A list of 59 references is included. (KC)

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"THE CUNNING HAND, THE CULTURED MIND": MODELS FOR INTEGRATING VOCATIONAL AND ACADEMIC EDUCATION

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A previous version of this paper, dated March 1990, circulated widely and was presented at numerous conferences. The comments of participants at these conferences, too numerous to mention and often anonymous, were helpful in this revision, as were the comments of an anonymous reviewer.

Above all, we wish to thank the scores of administrators and teachers in the many schools we visited for their time, information, and observations. We found them almost universally eager to cooperate, despite the demands we made on their scarce time. Their enthusiasm for the reforms they were undertaking was unmistakable, and their insights were often penetrating. We hope this report can repay their efforts by bringing their innovations to wider attention.

This report is part of a larger effort of the NCRVE to examine the integration of vocational and academic education. Other research will be presented in reports by Jerry Pepple of the University of Illinois; June Schmidt of Virginia Polytechnic Institute and State University; Cathy Stasz and Sue Bodilly of the RAND Corporation; and George Copa and Robert Beck of the University of Minnesota. These individuals, the authors of this report, and others affiliated with the NCRVE, including its director Charles Benson, its Associate Director Gerry Hayward, and David Stern of the University of California at Berkeley, participated in a conference in August 1990 which helped clarify several crucial issues.

The NCRVE will continue examining the integration of vocational and academic education at both the secondary and postsecondary levels. We would like to hear from individuals and schools attempting various forms of integration, particularly as funds designated for the integration of vocational and academic integration begin to flow from the Carl D. Perkins Vocational Education Act.

INTRODUCTION

Efforts to integrate vocational and academic education have all the signs of a new movement. Policymakers trying to reform vocational education, business people decrying the skill deficiencies of students and the "narrow vocationalism" of the schools, vocational educators striving to find a new relevance for their programs, critics of conventional "academic" teaching, and cognitive scientists claiming to find new theories of learning—all these and others have pounced on integration as a solution to old problems of the high school. Several states have initiated their own programs to encourage such integration, and recent federal legislation requires integration as a condition of receiving federal funds. At the local level, where the most exciting developments are taking place, school districts are experimenting with many different approaches, developing programs which make sense for their students, their resources, and their labor markets.

For all this ferment, the concept of integrating vocational and academic education remains remarkably diffuse. Integration seems like such a good idea, but what it entails—what is integrated with what, what an integrated curriculum might look like, which practices have to change—is much less clear. The developments that different schools and states call integration vary widely: Some efforts are magnificent, while others sound good but lack substance.

This report tries to make sense of the integration of vocational and academic education and to describe various approaches to integration based on observations in many schools. To begin with, support for integration has many different strands. Indeed, the multiplicity of purposes surrounding recent changes is one reason for the variety of approaches and the uncertainty about what integration means. However, the coexistence of many purposes has also generated a richness and creativity in the fledgling efforts to integrate vocational and academic education, efforts which represent a kind of natural laboratory.

Secondly, we outline eight different models of integration, describing how high schools have changed their curricula and restructured their program and course offerings. These models are not simple or monolithic; each of them includes a variety of practices and approaches, including some which are remarkably innovative and others which are the

most trivial forms of integration. Even so, they do provide visions of how current practices can change and answers to the question of "what to do on Monday morning," with enough variety so that they can be adapted to the infinite differences of the American secondary schools. In addition, it is crucial to recognize that integration can be a dynamic process: Schools can start with modest approaches and incorporate additional changes over time.

Although there are many exciting schools and enormous creativity focused on the task of integration, some innovations have accomplished much less than their creators envisioned, and many others have fizzled. This is hardly surprising: Vocational and academic education have been growing apart at least since 1890; the split between the two is a deep one—one which affects content and purpose, teaching methods, teacher training and philosophy, the kinds of students in vocational and academic programs, and status. Healing this division is a difficult and time-consuming process.

The third section clarifies the requirements for successful efforts at integration, indicating the importance of consistency among the many groups that affect the schools. This section also outlines what resources are most crucial, and addresses the need for sustained effort and the institutionalization of reform. The problem of what to do over the long haul is important because short-term staff development, short-term pilot projects, or the addition of even more freestanding courses to the overcrowded high school schedule may be useful, but they stand no chance of reshaping the high school in any important way.

Despite these difficulties, the potential of efforts to integrate vocational and academic education is extraordinary. Not surprisingly, the purposes and the ambitions of different approaches vary substantially, as we indicate in the fourth section. Some—particularly those that beef up basic skills within existing vocational courses—are modest in the changes they make. However, the most ambitious models we outline—particularly those that develop occupational clusters or "career paths"—not only change the content and methods of existing vocational and academic courses, but also address some deeply rooted failures of the high school that have almost nothing to do with vocational education itself: the inability of the schools to help students think about future occupations and the vocational consequences of educational choices, the chaos of the "shopping mall high school" (Powell, Farrar, & Cohen, 1985), the disengagement of students, the

ineffectiveness of conventional teaching, the isolation of teachers, the inequities of tracking, the liabilities of an overly narrow conception of vocational education, and the isolation of the schools from the adult worlds of business and politics.

The final section clarifies the contributions that different models of integration can make to these enduring problems. These are, in our view, the most important contributions that integration can make to reforming the American high school, and they deserve the attention of everyone—whether interested in vocational education or not—concerned about the state of secondary education.

This paper is based almost entirely on our observations of schools and our interpretations of what we have seen. Appendix A describes the methods we used, and lists the schools we visited. In reporting our findings, we have omitted the names of the schools we visited; in a few cases we refer to them by pseudonyms. (We depart from this practice only in cases of schools that have been described in the literature, including those presented in Adelman, 1989, and Pritz & Crowe, 1987.) We do this in part because we promised anonymity to the schools we visited and the teachers we observed, and in part because we wanted to be free to detail the shortcomings of the schools we observed as well as their real successes. In addition, given the intense interest in integrating vocational and academic education, we want to spare these schools crowds of visitors.[1]

We regard the movement to integrate vocational and academic education as only barely underway. Even the longest running innovations are barely five years old, and their creators often describe them as "just beginning." State efforts are similarly recent, and federal legislation requires schools to begin using federal funds for integration only in the 1991-1992 school year. We assume—and we hope—that school districts will view integration as a dynamic process in which they move from small changes to more thorough reforms, and that new forms of integration will emerge that make the approaches described in this report incomplete, if not obsolete. It is important to start somewhere, however, and the practices we outline provide ways to start that are both practical and visionary.

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[1] One of the schools we visited—the school we call Landon High that is profiled in Model 8—had over fifty groups of visitors in 1988-1989.

THE STRANDS OF INTEREST IN INTEGRATING VOCATIONAL AND ACADEMIC EDUCATION

In the beginning, the division between vocational and academic education did not exist. During most of the nineteenth century, when public elementary and secondary education was established in this country, there was little specific vocational training in the schools. Instead of the current differentiation of the high school, a general belief prevailed in the ideal of the common school, where all students should learn the same subjects—the subjects we now consider the academic curriculum. As late as 1894, a committee examining the high school curriculum declared that "every subject which is taught at all in a secondary school should be taught in the same way and to the same extent to every pupil so long as he pursues it, no matter what the probable destination of the pupil may be, or at what point his education is to cease" (NEA, 1894; see also Krug, 1964, Chapter 3).[2]

The first introduction of more obviously vocational material into the high school still espoused a unitary curriculum. The manual training movement of the 1880s developed graduated exercises in woodwork and metalwork—not to give students the specific skills necessary for employment, but to train them more generally in the uses of tools and the manipulation of materials, to round out their education, and to "train the mind by training the hand." Any notion of separating these exercises from academic learning was anathema to the manual training movement. As one of its leaders proclaimed (Woodward, 1887):

> Hail to the skillful, cunning hand!
> Hail to the cultured mind!
> Contending for the World's command,
> Here let them be combined.

But the insistence that all youth be educated in both academic competencies and technical abilities was soon forgotten in the movement for vocational education.[3] The pressure for more utilitarian forms of education, preparing students for immediate employment, led to a greater stress on specific skill training. In addition, as high schools came to include more

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[2] This report can be viewed as the swan song for the unitary high school curriculum, since even as it was written business education and industrial arts were expanding.

[3] In research being undertaken by Norton Grubb and Michelle Leversee, it appears that the manual training movement was much more limited than most historians have recognized. Even during the 1880s there were relatively few schools that followed the principles of manual training, and they virtually disappeared after 1900.

lower-class, immigrant, and black students, the idea developed that education ought to be differentiated according to the "evident and probable destinies" of students. Those destined for working class jobs should be in vocational tracks, while those bound for managerial and professional positions should be in academic programs. The success of the movement for vocational education, the coming of federal aid for vocational education in 1917, the growing practice of tracking, the introduction of testing as the basis for differentiating students, and the continued expansion of the high school, with more and more lower-class and immigrant students considered appropriate for vocational education, all reinforced the divisions between vocational and academic education (Lazerson & Grubb, 1974; Kantor, 1988).

Still, even as vocational and academic education continued to separate, doubts arose about the utility of this division. The first major review of vocational education—the Russell report of 1938, the result of a committee appointed by President Franklin Roosevelt—criticized vocational education for promoting a narrow conception of vocational education with overly specific training and for encouraging a dual structure segregating vocational education from academic education, amounting to a "caste system" linking social class to curriculum. The committee recommended that vocational education be made more general and flexible, that it become better connected to the academic curriculum and provide "a broad range of basic abilities of value in a whole related family of occupations" (Lazerson & Grubb, 1974). Later reports in 1963 and 1968 followed the same criticism, taking vocational education to task for its narrowness and job specificity, and federal legislation—the 1963 Vocational Education Act and the 1968 Amendments—tried again to make vocational education more general (Grubb, 1978).

In the recent interest in integrating vocational and academic education, many of the older criticisms of vocational education have re-emerged. Evidence about the ineffectiveness of vocational education, central to the Russell report, mounted throughout the 1970s and 1980s (Reubens, 1974; Grasso & Shea, 1979; Meyer, 1981; Rumberger & Daymont, 1984 ; Stern, Hoachlander, Choy, & Benson, 1986).[4] Such findings have been damaging to the cause of vocational education: If vocational programs cost more than

[4] However, Rumberger and Daymont (1984) did find some returns for those students taking a vocational program who managed to find employment related to their course of study. For another more positive evaluation of high school vocational programs, see Kang and Bishop (1989). Of course, there may be goals for secondary vocational education other than employment benefits, particularly with a shift toward more general conceptions of vocational education.

academic programs, take students away from more academic coursework (including the courses that might lead them to postsecondary education), and still fail to provide any labor market advantages, then the rationale for vocational education evaporates. A typical reaction to negative findings was that of Stern et al. (1986) who called for integrating vocational and academic education rather than training for specific entry-level jobs as a way of invigorating *academic* education:

> Through practical application, theoretical ideas can come alive for students. Vocational education should no longer be seen as another set of subjects competing for students' time. It should be a set of activities that help students use, understand, and appreciate what they are learning in other courses. This kind of vocational education will increase students' long-term productivity as workers by encouraging them to understand the theory underlying the work they do. (p. 50)

Around the same time, the business community discovered a new "crisis": a shortage of basic skills in the workforce, as well as workers unequipped with problem-solving abilities, the capacity to continue learning as they progressed through more demanding jobs, and other skills often labeled "higher-order thinking skills." As business representatives[5] called for the reconstruction of American education, they also called for a broader form of education. The Committee for Economic Development (CED) (1985) declared, "Business, in general, is not interested in narrow vocationalism. It prefers a curriculum that stresses literacy and mathematical and problem-solving skills." As an antidote to academic deficiencies among vocational students, this group proposed a curriculum emphasizing academic capacities over vocational skills[6]:

> Before any student is allowed to complete occupationally specific training, he or she should be required to demonstrate achievement of an adequate level of academic competence. Similarly, vocational education majors should be expected to complete a core curriculum in addition to occupationally specific training. (pp. 31-32)

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[5] The business community does not always speak with one voice. The national commission reports that attract the most attention usually include representatives of the largest, most socially conscious corporations, often those competing actively in the international economy—corporations that can afford to do their own specific training and that must take the long-run view about the capacities of the labor force. However, the small- and medium-sized firms that operate in subnational labor markets and that often cannot afford to do their own training are more likely to pressure educators for specific skill training; the recent surge in customized training and in state funding for specific training linked to economic development are good examples.

[6] Careful readers will note that the CED report calls not for the integration of vocational and academic education, but for the creation of better academic prerequisites before a student is allowed to take occupationally specific education. This is a model of integration, but only in the sense of establishing a sequence. Note the subtitle of the section of the report containing this recommendation: "Academics First."

Other business groups that stressed the pace of technical change in the workplace also promoted more general competencies over job-specific training. As the Panel on Secondary School Education for the Changing Workplace of the National Academy of Sciences (1984) concluded,

> The education needed for the workplace does not differ in its essentials from that needed for college or advanced technical training. The central recommendation of this study is that all young Americans, regardless of their career goals, achieve mastery of this core of competencies up to their abilities. For those intending to enter the work force directly after completing high school, additional training in specific vocational skills will increase employability and is naturally desirable. But no other skills, however useful or worthwhile, can substitute for the core competencies. (p. 19)

A third strand of support for integrating vocational and academic education has come from vocational educators themselves. Some have shared the concern of the business community with deficiencies in basic skills among vocational students. A consortium of schools in the Southeast has been organized by the the Southern Regional Education Board (SREB); this board is "dedicated to strengthening the basic competencies of students enrolled in vocational education programs" by raising expectations, eliminating general track courses, and instituting "vigorous and coherent program[s] combining academic and vocational study" (Bottoms & Presson, 1989, pp. iii; vi). Other vocational educators responded more specifically to the reform movement of the 1980s, which generally increased graduation requirements, leaving less room in the high school schedule for vocational education and reducing enrollments in many states (Clune, White, & Patterson, 1989). Vocational educators reaffirmed the importance of their approach to education, stressing the role vocational education might play in making education more real, more "relevant," for a large number of students:

> Many young people enter high school already turned off to the learning process. More of the same is not the answer. Motivating students not only to do better, but also, in many cases, to remain in school, is the critical task of education. Vocational education is frequently the catalyst that reawakens their commitment to school and sparks a renewed interest in academic skills. (p. 2)

While many vocational educators responded to the "crisis" of enrollments by restating the value of traditional programs, others called for a reformulation of vocational education, broader in scope, more general in the skills transmitted, and more carefully connected to the rest of education (National Commission on Secondary Vocational Education, 1985).

> What is really required today are programs and experiences that bridge the gap between the so-called "academic" and "vocational" courses. The theoretical and empirical bases as well as the practical and applicative aspects of academic courses and vocational courses must be made explicit and meaningful. This calls for a joint effort between the academic teachers and vocational teachers. (p. 14)

Several strands of support for integrating vocational and academic education have emerged, then, from criticism of conventional vocational programs, suggesting that vocational education should either change or wither. A different source of support has attacked the academic programs of the high school. Vocational educators themselves have noted the deficiencies of the standard academic curriculum, and, therefore, of reform efforts (especially "more of the same") which would merely intensify and lengthen the academic program. More generally, a long history of criticism of the academic curriculum exists, castigating it for being arid, boring, too dominated by "teacher talk," with little opportunity for students to participate more actively.[7] These are deficiencies that vocational education addresses in theory: At its best, vocational education incorporates more participatory forms of learning, based on activities of intrinsic interest rather than abstract task, and providing more opportunities for student initiative and cooperative learning among students rather than the teacher direction and the "teacher talk" that dominates most classrooms (Sirotnik, 1983).

The voices of educational critics have been joined by those of cognitive scientists, a loose network of psychologists, anthropologists, sociologists, and students of artificial intelligence. One conclusion from this emerging field is that knowledge (especially expert knowledge) is often specific to a particular activity or area of expertise, and that for most people effective learning requires a context that matters to them. In particular, most learning (including learning in the workplace) takes place in ways quite different from the form it takes in schools. Most learning takes place in groups and requires cooperation, while most school-based learning is an individual activity; it relies on using both simple and complex tools, whereas school-based learning emphasizes thinking that is relatively independent of tools. Most importantly, schools emphasize relatively abstract forms of learning disconnected from the "real worlds" of work, family, and community—as schools themselves are disconnected from these worlds—rather than connecting learning to events,

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[7] For criticisms in the 1890s that sound quite modern, see Cremin (1961). For more recent criticisms, see Powell, Farrar, and Cohen (1985); Boyer (1983); Goodlad (1984); and Sizer (1984).

people, and objects that have some meaning to them such as the tasks required on the job, the chores necessary around the home, or the routine activities of community members and citizens (Resnick, 1987; Raizen, 1989). But, of course, vocational education has always tried to provide a context for learning which is intrinsically important—to teach the use of tools and use tools as aids to further learning and to promote learning in groups and group projects rather than individual learning; therefore, it seems to exemplify the emerging principles of cognitive science.

Finally, policymakers at the federal level have added their own pressures for integrating vocational and academic education. In the most recent manifestation of the continuing pressure to make vocational education more general, the 1990 Amendments to the Perkins Act require that every program supported by federal funds "integrate academic and vocational education in such programs through coherent sequences of courses so that students achieve both academic and occupational competencies" (Section 235). Federal legislation, therefore, provides both the resources for integration and the pressure to do so.

There is one final promise of integrating vocational and academic education, which is less often articulated, but still important. The historical split between vocational and academic education initially differentiated students as well as curricula, with vocational tracks for those intending to enter employment increasingly distinct from academic tracks for college-bound students. Other forms of differentiation then emerged—particularly ability grouping, preparing those students bound for vocational programs differently from those likely to go into academic tracks. Unfortunately, the spread of tracking has been detrimental to most students: The best evidence suggests that tracking reduces the achievement of those placed in lower tracks without improving the performance of upper-track students (Oakes 1985). One potential of efforts to integrate vocational and academic education, then, is that students who are segregated in the conventional high school might be more often combined in relatively heterogeneous classes. Indeed, a truly integrated curriculum which aspired to prepare students for both employment after high school and postsecondary education would have little need for extensive tracking. In the integration efforts we have seen, this possibility has usually been ignored, and it has not figured prominently in the rhetoric surrounding integration. Still, any change which promises to narrow the deep divisions of American high schools is worth exploring.

There are, then, many strands to the support for integrating vocational and academic education. However, the purposes behind this support vary: Some want most to remedy the basic skill deficiencies of vocational students, while others stress "higher order thinking skills"; some focus on reforming a moribund vocational education, while others want to reinvigorate the academic curriculum, and still others stress the benefits of new forms of education to employers. When we turn to what educators have done to integrate vocational and academic education, it is not surprising to find these differences reflected in the variety of approaches.

MODELS OF INTEGRATING VOCATIONAL AND ACADEMIC EDUCATION

The recent arguments for integrating vocational and academic education are consistent with historically persistent critiques of the split between vocational and academic education. But none of the previous attacks on the separation of vocational and academic education led to serious efforts at reform. It has never been clear just what the integration of vocational and academic education might mean, what classroom practices might reflect integration, or how to start such a reform; the problem of "what to do on Monday morning" has been intractable.

The current wave of interest in integration is quite different. Several states have undertaken statewide efforts to integrate vocational and academic education, among them Ohio, Oregon, and New York[8]; others have invested in pilot projects, including California, Washington, Idaho, and Florida. A consortium of more than thirty schools in the Southeast, part of the SREB, has pledged its allegiance to principles designed to upgrade the vocational curriculum and improve the basic education of vocational students (Bottoms & Presson, 1989). The approach of "academies"—schools-within-schools—has been tried throughout the country from its inception in Philadelphia to its extensive replication in California. Numerous school districts have initiated their own changes, generating new curricula and new ways of organizing the high school; and magnet high schools oriented around vocational areas and single-occupation high schools have provided yet other ways

[8] We have not yet visited any New York schools; therefore, we have not included this initiative in our findings. For a description of three schools in New York, see Adelman (1989).

in which academic education might comfortably and naturally be infused into vocational programs. Curriculum development has proceeded as well: A number of publishers now offer materials to incorporate basic skills into vocational courses, and "applied academics" curricula—versions of academic courses such as physics, math, and English with more occupationally relevant content—have proliferated.

Clearly, there is a great deal of ferment and experimentation across the country, considerable excitement about new approaches to secondary education, and many new experiences from which others can learn. However, the efforts at integration are extremely varied, and what they have accomplished—and what they are trying to accomplish—are not always clear. The purpose of this section, then, is to describe the efforts at integration, to disentangle ambition from implementation, and to describe the strengths of different approaches. We have chosen to describe various models of integration, rather than specific schools.[9] These models are idealized versions of what we have seen; they describe the visions of those who have tried to integrate vocational and academic education, as much as (and sometimes more than) what these individuals have accomplished. The reason for describing models rather than actual practice is that many schools have only begun putting their visions into practice; others have faced enormous problems which have slowed their progress—resistance from administrators, teachers, state agencies, and parents still distrustful of vocational education. In some cases, the changes that have taken place are quite trivial, even though the vision behind them is magnificent. For the purpose of suggesting approaches that others might try, the vision of what might be accomplished matters the most.

The models we present typically combine experiences from several different schools. They are best understood as general approaches to integration which can have many variations rather than as models which are unitary and monolithic. For example, some schools have chosen to begin their efforts with the English curriculum, others with math or science; some have been most successful with certain vocational programs (e.g., electronics, drafting, or machining), while others have tried to include all vocational programs in efforts at integration. The Academy Model can be applied to a variety of different occupational fields, and schools that include "at-risk" students only have different experiences from those who have included those of middling ability levels. It is important

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[9] By contrast, see Adelman (1989), who chose to describe specific schools.

to think about these models flexibly and creatively; they allow many possible kinds of experimentation and change, and several can be adapted to different kinds of schools. Therefore, the simple summary of these models, presented in Table 1, must be interpreted with care since there is considerable variation within each of these approaches.[10]

In the variety of approaches to integration we have seen, in the eight different models we describe, and in the extensive variation within each model, there is an important lesson: *Many approaches to integrating vocational and academic education exist, rather than a single model that could apply to all schools.* These approaches have emerged partly because of different perceptions of what problems are most important. In addition, existing schools vary enormously: An approach that works for an area vocational school with feeder high schools may be completely unworkable in a comprehensive high school, while a model suitable for a magnet high school or a comprehensive high school with a rich array of sophisticated vocational courses will not work in a high school whose vocational offerings have been stripped to the minimum. *It would be misguided for federal or state policymakers to impose a single model of integrating vocational and academic education, or for educators to decide upon one "best" approach.* Such a tactic could only limit the creativity of teachers and administrators trying to change the schools. A single approach would also be doomed to failure in those schools where it is unsuitable for any number of reasons, including the nature of existing vocational and academic offerings, the interests of students, the attitudes of teachers and administrators, and the resources available.

As will become clear, the ambitions of these models vary enormously. The first of the models we present has the most restricted ambitions; others have the potential for reshaping every aspect of the comprehensive high school. Some of them (especially the first two) operate by modifying the vocational curriculum; others (especially the third model) work primarily by changing the academic curriculum. The most ambitious change both the vocational and academic curricula. Some reform individual courses, while others reshape entire programs stretching over three or four years. All of these models have some promise, however, and respond to certain problems which reformers have considered

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10 Some readers of an earlier version of this paper have criticized our eight models as being insufficiently theoretical and philosophical. This criticism may be valid, but we regard categorization as an expedient mechanism to describe a wide variety of practices rather than a derivative of some abstract theory. Our models progress from relatively simple to more complex, and they group practices according to their most salient changes.

TABLE 1

Models of Integrating Vocational and Academic Education

	Curriculum Changes	*Teacher Changes*	*Students Targeted*	*Institutional Changes*
1. Incorporating more academic content in vocational courses	Vocational courses include more academic content	Vocational teachers modify courses	Vocational students	None
2. Combining vocational and academic teachers to enhance academic content in vocational programs	Vocational programs include more academic content, in either vocational courses or related applied courses	Academic teachers cooperate with vocational teachers	Vocational students	None
3. Making academic courses more vocationally relevant	Academic courses include more vocational content; sometimes new courses (e.g., applied academics) adopted	Academic teachers (usually) modify courses or adopt new ones	Potentially all students; in practice, vocational and general-track students	None
4. Curricular alignment: horizontal and vertical	Both vocational and academic courses modified and coordinated across courses and/or over time	Vocational and academic teachers cooperate; numbers range from two to all	Potentially all students; actual targets vary	None necessary; curriculum teams may foster cooperation

	Curriculum Changes	*Teacher Changes*	*Students Targeted*	*Institutional Changes*
5. Senior projects	Seniors replace electives with a project; earlier courses may change in preparation	None necessary; teachers may develop new courses or modify content to better prepare students	All students	None necessary
6. The Academy Model	Alignment among academy courses (English, math, science, vocational) *may* take place	Vocational and academic teachers may collaborate on both curriculum and students	Usually potential dropouts; sometimes students interested in specific occupational areas	School-within-a-school; block rostering; smaller classes; links to employers
7. Occupational high schools and magnet schools	Alignment among all courses may take place, emphasizing the occupational focus	All vocational and academic teachers assigned to an occupational school or magnet within a school; collaboration facilitated	Students interested in specific occupational areas	Creation of a self-contained occupational school or magnet school
8. Occupational clusters, "career paths," and majors	Coherent sequences of courses created; alignment may take place among courses within clusters	Teachers belong to occupational clusters rather than (or in addition to) conventional departments; collaboration facilitated	All students	Creation of occupational clusters; enhancement of career counseling; possible cluster activities

crucial. We think it important at this stage to stress the contributions each model can make, rather than the limitations of each.

Finally, the conceptions of both vocational and academic education vary among these approaches. In some schools, the "academic" material incorporated into vocational courses is quite basic or remedial,[11] and some of the vocational courses are relatively unsophisticated, too. In other cases, the most advanced academic subjects have been incorporated into programs which include vocational curricula of relative complexity. Some schools still try to provide job-specific skills in their vocational programs, useful in employment immediately after high school, while others have come to view vocational education as a more general form of preparation for either employment or postsecondary education. However, the range of comprehensive high schools in the United States is enormous, and the range of competencies in their student bodies is enormous as well. Given these realities, many different forms of integrating vocational and academic education are necessary. It would, in our view, be unwise to ignore those models which are frankly remedial since they may have as much promise in shaping another generation of competent students as those which aspire to educating well-rounded engineers, managers, and professionals.

There are two approaches to educational reform, sometimes considered integration, which we have not included because we think them uninteresting and unproductive. One is the effort to establish new academic requirements before students take vocational programs—the recommendation, for example, of the Committee for Economic Development. This has in effect happened with more stringent graduation requirements and the competency exams (or exit exams, including tests of basic skills) that have proliferated in many states. But this approach does nothing to change either the vocational or the academic curriculum, or to integrate courses, teachers, or students. Even if it increases the rigor of high school programs, it can do nothing to change the existing deficiencies of the academic curriculum.

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[11] In this report, we use the terms basic education and remedial education as synonyms because, in practice, the educators we interviewed and the programs we observed used them. The curriculum materials we have seen labeled "basic skills" or "applied basic skills" are similarly remedial by almost anyone's definition.

The other approach we ignore has been the attempt to get existing vocational courses to count as academic courses for graduation requirements. In theory, such efforts could change the content of vocational courses by incorporating more relevant academic material, and in some cases this has in fact happened. In other cases, however, nothing has changed. In one school district we visited, which had managed to get many of its vocational courses to count through an elaborate process of documenting their academic components, none of the vocational courses had changed in any substantial way. The models we present have all changed educational practice in one form or another, rather than simply relabeling existing practice.

Model 1: Incorporating More Academic Content in Vocational Courses

Probably the simplest form of integrating vocational and academic education is the effort to incorporate more academic material into existing vocational courses. Sometimes this happens informally, when principals urge their vocational faculty to include more writing exercises in their regular courses, to participate in "writing across the curriculum," to use more "academic" assessment practices such as essay exams, or to identify and remediate deficiencies in mathematics related to a vocational subject. Sometimes vocational teachers themselves uncover a basic skill deficiency and then remedy it, taking time from workshop exercises and vocational skills training to practice the specific mathematics skills required in vocational classes (e.g., measurement with rulers and protractors in carpentry and metalworking classes, the algebra underlying Ohm's Law in electronics, and the simple trigonometry involved in using sine bars in machining classes), to spend time on comprehension exercises drawn from instructional manuals, or to write business letters and resumés in business occupations classes. In other cases, vocational instructors have deliberately built academic instruction into their curricula because employers expect such skills.

Many vocational teachers assert that this approach is "just doing what we've always done," suggesting that integration is a simple process of reinforcing basic academic skills or of helping students apply the abstract skills they have learned elsewhere. Others have acknowledged that they are under pressure to reduce the time spent on vocational skills

training and to increase attention to more clearly "academic" exercises. Some vocational instructors fear that this will undermine the vocational content of their classes; a common phrase is that it may compromise "the integrity of the vocational curriculum." This suggests that the use of time is a zero-sum game with an emphasis on academic skills coming at the expense of vocational skills, an emphasis welcomed by some but resented by others.

A more formal approach is to rely on curriculum materials, rather than the informal pressure of principals or the initiative of individual vocational instructors. Several curricula have been developed for use by vocational instructors to incorporate more basic skills into existing vocational courses. Some are curriculum materials which could be used in the classroom, and some are readings—articles urging the improvement of basic skills or illustrating what approaches to take and checklists of academic competencies—to enable teachers to develop their own materials; we have listed some of these in Appendix B. Activities related to reading and writing include reviews of basic grammar and punctuation, but use examples that are occupation-related such as punctuating the sentence "Inez attended dental school for several years in Dallas, Texas, before she decided to become a nurse"; doing crossword puzzles and other word games using job-related vocabularies; writing various kinds of employment-related letters, completing job applications, and filling in income tax forms; developing reading skills—for example, identifying main ideas, distinguishing fact from opinion, and using job-oriented texts; and presenting relatively simple written information about a variety of occupations in the name of career education. Math exercises include presenting simple algebraic formulas (e.g., Ohm's Law and Joule's Law), making simple arithmetic calculations (e.g., the board feet of lumber required on a project, or the amount of cement a bricklayer might need), using measuring devices, and reading graphs, charts, and tables of numbers. The applications of science are quite varied, and some are quite far from what any academic teacher would consider science: One guide presents simple reading passages describing what astronomers and plumbers do, reviews the order of the planets in the solar system, and presents crossword puzzles using words such as "antibody" and "inoculate." Another guide from the same publisher is much more sophisticated, presenting the scientific principles and algebraic formulas appropriate to various machines (e.g., turbines, steam engines, band saws, and drill presses) and to production processes (e.g., injection molding and metal cutting). With only a few exceptions, these materials present examples from a variety of occupations, rather than

being specific to clusters of occupations and, therefore, to specific vocational courses such as agriculture, business, or home economics.[12]

Even a cursory review of these curriculum materials reveals the wide range of academic skills presented. In general, however, the level is relatively low: Much of the math is simple arithmetic, and almost none of it is more advanced than single-equation algebraic formulas or formulas for the volumes of simple geometric shapes; the literacy exercises stress reading and writing to learn and present factual information; and some of the science illustrated in these volumes invokes the subject, but doesn't teach anything about scientific principles, methods, or knowledge. These materials are, therefore, largely remedial. They use vocational settings and examples to motivate students to learn basic skills which they have missed in their prior schooling, and they may represent exemplars of contextualized learning; but they do not force teachers to elevate demands on students much beyond these basic levels.

It is unclear how such materials are used by vocational teachers. We have never observed such guides being followed in vocational classrooms, and several vocational instructors who have tried these materials reported them to be useless—too time consuming, not occupationally specific enough, and sometimes inaccurate. However, we have not systematically surveyed teachers about their use of curriculum materials. The availability of such materials is clearly a help to vocational teachers searching for ways to enhance basic skills instruction in their classes. Even so, for those vocational teachers who are reluctant to shift time away from vocational skills instruction, the existence of curriculum materials on the shelf may not provide much incentive to change.

A still more formal approach is to develop model curricula for vocational courses that incorporate basic or academic skills components. This could be done by an individual school district or by a consortium of school districts,[13] but it is more common for states to sponsor such efforts. For example, California is now in the process of developing model curriculum standards and program frameworks, encompassing a wide range of both vocational and academic courses. The process of developing the frameworks has been

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[12] The exception we have seen is the series produced by the New Jersey Department of Education to reinforce math, reading, and writing in consumer and homemaking education.

[13] For example, *ACTIVE: Academic Competency Taught in Vocational Education*, a report providing curriculum materials, was developed by four vocational centers and a comprehensive high school in Michigan.

quite complex, with many vocational teachers involved in agreeing what should be included and in testing the initial versions. The frameworks are specific to vocational areas (e.g., business, agriculture, and home economics). Each of them contains three levels of *competencies*: (1) Core competencies taught in introductory courses include general employability skills, basic academic capacities, self-management of learning, career exploration, and maturity, as well as mastery of occupational knowledge and practices; (2) Cluster competencies taught in intermediate courses cover knowledge and practices pertaining to any entry-level job in an occupational cluster; and (3) Job-specific competencies taught in "capstone" courses at the end of a vocational sequence prepare students for placement—in the case of business, for example, job-specific competencies are specified for payroll specialist, accounts receivable specialist, computer accounting specialist, office receptionist, secretary, word processor, and medical secretary. For each competency, there is a list of *proficiencies* which students are supposed to be able to perform; these proficiencies suggest classroom exercises that teachers could use. Many of the competencies (and the related proficiencies) are relatively general or academic abilities, including those related to literacy and mathematical ability. The frameworks are not curriculum materials, therefore, but they do indicate which academic abilities ought to be incorporated into specific vocational programs and what exercises might be appropriate to doing so. A similar approach has been taken by Texas and Florida in developing "essential elements" for a variety of vocational and academic courses, with the important exception that curriculum frameworks in California will be voluntary, while teachers in Texas are required to demonstrate that their courses incorporate all "essential elements."

The development of model curricula that show which academic competencies should be included in vocational courses is a step beyond the publication of curriculum guides. The process of developing such curricula forces teachers out of their classrooms and requires them to come to some consensus about what is most important in their field. The process itself may generate enthusiasm and support for the model curricula, and the fact that local teachers have developed the curriculum may improve its chances of being adopted. In general, the model curricula we have seen are more detailed than the curriculum materials developed for a national audience, and they are specific to vocational areas rather than presenting examples from a broad variety of vocational subjects. Finally, the existence of curriculum standards statewide generates some pressure—either the pressure of an exemplar such as in the case of the voluntary California frameworks, or the coercion of state requirement such as in the Texas case—for vocational teachers to change

their practices, something which may not happen merely with the availability of yet another curriculum guide.

However, this approach is also subject to all the limitations of curriculum development. Such efforts often look like efforts to "teacher-proof" the curriculum, to develop materials that can be taught regardless of the ability of teachers or their commitment to the subject at hand—in this case, to the integration of academic material into existing vocational courses. But we are convinced, on the basis of observations in many schools, that there is no way to "teacher proof" genuine integration efforts, since they depend on teachers embracing such integration and mastering enough of both "vocational" and "academic" materials—and the teaching methods that have traditionally been part of each—to develop a convincing synthesis. Model curricula are best understood as materials from which skillful teachers can draw examples and suggestions, not as ways of coercing teachers into doing what they have neither the inclination nor the ability to do.

This first approach to integrating vocational and academic education has many obvious advantages. It can be done within existing vocational courses without much disruption or expense; it does not require the coordination of large groups of teachers (save possibly for the process of developing model curricula). It has the potential for increasing the academic capacities of vocational students as technical requirements of occupations increase. For those students who have not mastered the basics of reading, writing, and math, this approach can improve basic skills in a way that is more concrete and more clearly related to students' occupational futures and current vocational preparations than are the conventional academic classrooms. It can also serve as a crucial first step in a longer process of integrating vocational and academic education.

However, the ambitions of this first model are limited. The academic competencies which have been most frequently stressed are relatively simple, in some cases embarrassingly so. More to the point, this model does nothing to change the essential division between vocational and academic courses, between vocational and academic teachers (since academic teachers need never be involved in this approach), or between vocational and academic students (since only vocational students are affected by these changes). It is relatively simple for recalcitrant vocational teachers to relabel some of what they have always taught as basic skills and to let it go at that. This approach leaves the academic and general tracks alone, as well as the career guidance and counseling function

of the high school, which affects all students' vocational deliberations. Compared to other models which follow, then, it can remedy only some of the ills resulting from the division between vocational and academic education.

Model 2: Combining Vocational and Academic Teachers to Enhance Academic Competencies in Vocational Programs

A different approach to integration is to enhance the teaching of academic competencies in vocational programs, but to give the responsibility for doing so to academic teachers. A good example is an area vocational school—which we will call Smithville Area Vocational Center—with fifteen vocational instructors joined by two academic teachers, one certified in English and the other in math. (In this case, students spend half the day during their junior and senior years in the area vocational school, with the remainder of the day in their home high schools spent on conventional academic subjects required for graduation.) The academic teachers work in several different ways. They sometimes teach individual lessons or modules in vocational classrooms, presenting academic materials (or reinforcing existing competencies) relevant to that particular occupational area. Second, they help vocational instructors develop more "academic" exercises of their own; for example, they may collaborate on writing exercises, essay questions and essay exams, arithmetic and algebra reviews, and the like. Third, they may pull individual students out of vocational classes for intensive work on subjects in which they are having difficulty, serving as in-house remedial teachers. Finally, the math teacher teaches one class of Applied Mathematics (a curriculum described below), allowing students to receive credit toward graduation for a math course more related to their vocational programs than the general math course they might have taken at their home high school.

The most thorough approach[14] to combining vocational and academic teachers has been developed in Ohio, in its Applied Academics program (*Applied Academics*, 1990).[15] This program, which can be elected by area vocational schools and comprehensive high

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14 This model also exists in other forms with less substantial changes than in either Ohio or Smithville. In South Carolina, which requires a basic skills test for graduation, several area vocational schools include academic teachers, principally to provide remedial instruction to students who have previously failed the basic skills test. As in the Smithville Area Vocational Center, their presence may prompt other forms of collaboration, though we did not see much evidence that this takes place in South Carolina.

15 For the Ohio program, see also the description of the Montgomery County Joint Vocational School in Adelman (1989) and the descriptions in Pritz and Crowe (1987).

schools alike,[16] grew out of earlier approaches requiring vocational instructors to teach "technical-related" subjects, which included the academic content related to that vocational area. With increasing graduation requirements, the new program now has academic instructors teaching classes in applied academics (for graduation credit in academic areas), while vocational instructors continue to teach technical-related material as well as vocational skills. In addition to accommodating new graduation requirements, the Applied Academics program also shifts the emphasis of vocational education in the direction of preparation for both employment and postsecondary education; virtually every school has several 2+2 programs with neighboring community colleges, and about twenty percent of vocational students continue to postsecondary education.

In practice, almost all applied academics classes are specialized to specific vocational areas. For example, an applied math instructor will teach one class to auto body students, another covering different areas of math to machining students, and yet another to students in a CAD program. Most academic teachers spend one period a week in each of the vocational laboratories in which they have students; one science teacher even went so far as to learn welding, and virtually all of them become familiar with vocational content through their weekly visits. The result is that the applied academics classes are focused on those skills necessary in specific vocational areas, with constant reference to how mathematical operations, communications skills, or scientific approaches will be used both in the vocational classroom and later on the job. In some schools, the vocational and academic instructors team teach the applied academic subjects; as we observed in the best of these classes, it was impossible to distinguish the vocational from the academic instructor, since each seemed equally familiar with both the vocational application and the academic content. However, even without team teaching, a close connection existed between the vocational areas and the content of applied academics classes in virtually every class. The level of student engagement was remarkably high, even late on a Friday afternoon; teachers consistently noted the advantage of the Applied Academics program in motivating students by providing them with clear reasons for learning and new forms of learning—more

16 There are three different versions of Applied Academics, differing in the amount of required time in applied academics, "technical-related" subjects, vocational labs, and funding per pupil. There are complex incentives to adopt different alternatives, but most schools have elected the two versions with the most time in applied academics. The majority of the schools electing the Applied Academics programs are area vocational schools rather than comprehensive high schools. By the mid-1900s the Applied Academics program will be required at all area vocational schools and some comprehensive high schools. For more information on these plans, see *Ohio's future at work: Action plans for accelerating the modernization of vocational education in Ohio* (1990).

by providing them with clear reasons for learning and new forms of learning—more collaborative and more student-initiated, with constant movement between applications in vocational labs and seatwork in adjacent classrooms.

A crucial feature of the Ohio Applied Academics program is that teachers develop their own curriculum materials for each of the classes they teach.[17] As a result, the content of each applied academics class is closely tailored to occupational requirements, and the need for academic teachers to collaborate with vocational teachers forges a relationship among teachers that would otherwise be missing. The cost of having to develop curricula is that teachers have to work harder. A few teachers note that it would save time to have materials available "off the shelf." Even so, almost universally they note that this would destroy the close connection between vocational and academic subjects and the collaboration among teachers. Clearly, the academic teachers in the Ohio schools we visited have been self-selected for their willingness to work with vocational students and teachers. Some of them are new teachers who are excited by the prospect of team teaching in novel schools with small classes; others appear to have been burned out by years of conventional academic teaching with unmotivated students, so they seek out schools where they can teach their subjects in very different ways.

There is, to be sure, some variation among the Ohio schools and among the teachers who have adopted the Applied Academics program. Some schools have just begun the program, so they are starting the lengthy process of putting together teams of vocational and academic teachers, developing curricula, and generating a new culture around teaching. Some teams of teachers have little rapport, not surprisingly. A very few vocational teachers resent their loss of control over academic content to academic teachers, and a very few academic teachers appear lukewarm about the vocationally driven content of what they teach. Such variation is unsurprising, of course; what is remarkable is how consistent the changes have been in a program implemented in an entire state, how much enthusiasm both vocational and academic instructors express, and how consistently vocational and academic material has been integrated.

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[17] It is crucial to note that the Ohio program has little to do with the applied academics available from the Center for Occupational Research and Development (CORD) and the Agency for Instructional Technology (AIT), described as part of Model 3. A few teachers in Ohio have borrowed lessons from the CORD and AIT courses, but almost universally they find these materials not worth using because they are not specific enough to particular occupational areas, are occasionally inaccurate, and fail to motivate students.

Compared to the first model, the real strength of this approach is the collaboration between the vocational and academic teachers. The vocational teachers have a resource that is normally unavailable to them, since communication between vocational and academic teachers is usually poor. To illustrate, in Smithville the carpentry teacher went to the math teacher with standard "cookbook" calculations used in carpentry (e.g., for the area of a hipped roof), and they were jointly able to develop the underlying algebra and teach the basic mathematics for these calculations. The teacher in the small appliance repair program found that students had difficulty understanding diagrams of refrigerant flow, and was able to develop a module with the English teacher that helped students understand these common diagrams.[18] The applications of algebra, by using Ohm's Law in the electronics class, and of trigonometry, by using sine bars in the machining class, were reinforced by both the vocational and academic teacher. Particularly for those vocational teachers who feel unsure about their grasp of the underlying academic materials, the presence of academic teachers who are responsible solely for working with the academic program is a special resource.[19] Similarly, academic teachers who have little knowledge of technologies and occupational requirements can turn to vocational teachers for examples, which can then be reinforced in both vocational and academic classes. The practice within many Ohio schools of academic teachers attending vocational labs once a week provides the clearest example, one which leads to applied academic classes being closely integrated or aligned with vocational classes (as we indicate in Model 4).

A second advantage of this model is that the very presence of academic teachers within a vocational program highlights the importance of academic material. Several vocational teachers in Smithville modified their curriculum to include more "academic" exercises because, they claimed, their consciousness about the need to include such teaching was enhanced by the circulation of the academic teachers. An example was the instigation of daily newspaper reading in the printing program, where the instructor stressed reading for vocational purposes (e.g., for typos, type size, and headlines) and for

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[18] The problem in this particular case was a relatively sophisticated one: Refrigerant diagrams and electrical diagrams are—like written language and mathematical notation—relatively abstract representational systems which students need to learn to "read." Beginning students have trouble with their interpretations of such diagrams, just as beginning readers and those new to algebra have trouble.

[19] A legitimate question is why this kind of cooperation is not possible within the comprehensive high school where vocational and academic teachers may be literally across the hall from each other. One answer is that secondary teachers are profoundly insulated from each other, even within single disciplines, and in most high schools they have no tradition of cooperation (Cusick, 1982; Flinders, 1988; Little, 1990); and, too, the distance between vocational and academic teachers is greater still because of the status differential between the two areas (Little & Threatt, 1991; Ball & Lacey, 1984).

content, particularly related to current events. In this particular school, with a close-knit faculty in a self-contained facility, the constant interaction among faculty facilitated interchange of all kinds. Such interaction has been further institutionalized in the Ohio Applied Academics program; in this environment, the collaboration of vocational and academic teachers is natural and constant in a way that would be rare in a comprehensive high school.

This second model has several distinct advantages over the first one, then, and illustrates the benefits of having vocational and academic teachers collaborate. It suffers, of course, from a need for resources: It is necessary to allocate funds for academic teachers to work specifically with vocational programs, and, because there is a great deal of team teaching in this model, the instructional cost per student is higher than normal. Consistently, we have found schools unable or unwilling to allocate the resources for team teaching, making it difficult for vocational and academic teachers to collaborate in the way this model requires.[20]

Another disadvantage of this approach arises in area vocational schools, the most common application we have seen. By their nature, area vocational schools remain segregated from the academic coursework in their feeder high schools, and they have little power to modify the content or teaching in these feeder schools. In addition, the students in area vocational schools remain segregated for half the day from those in the academic tracks. This model, therefore, operates solely by modifying the vocational curriculum and enriching it with academic material where appropriate; even so, in other ways it is powerless to integrate vocational and academic education.

The greatest drawback of the second approach, however, is ironically a result of its greatest strength. In both the Smithville example, and more generally in the Ohio Applied Academics program, the academic content is determined by the needs of the vocational components. As a result, vocational programs which prepare students for entry-level positions in occupations requiring relatively low levels of academic skills incorporate

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[20] Indeed, even in the Smithville Area Vocational Center, which we considered an exemplar of integrating academic material into a vocational program, we were distressed that the funding for the two academic teachers was insecure; they were funded from "soft" Perkins funds rather than "hard" state and local funds, and it was relatively clear that if Perkins funds disappeared their positions would be eliminated, rather than being supported from "hard" resources.

relatively basic academic skill instruction. Although electronics and drafting may require algebra, geometry, and trigonometry, individuals preparing to be secretaries, auto mechanics, and animal care workers need no more than simple arithmetic; and while those students preparing to enter many business fields need sophisticated reading and writing abilities, the relatively simple communications skills required in most entry-level occupations similarly set a ceiling on what it makes sense to teach. Without preparing students for a sequence or cluster of occupations requiring higher levels of academic competencies, it becomes difficult to justify providing much more than relatively basic academic instruction in most applied academics courses. As a result, many applications of Model 2 involve academic instruction that is largely remedial.[21]

Model 3: Making the Academic Curriculum More Vocationally Relevant

While the previous two approaches modify the vocational curriculum, a different tactic is to modify standard academic courses to make them more relevant to future vocations. As in Model 1, this can be done in several ways, ranging from the informal to the relatively formal.[22] The most common approach is for principals to urge academic teachers to incorporate vocational applications wherever possible; examples include using reading materials which describe individuals at work or literature about work; assigning instruction manuals for comprehension exercises; including job-related writing exercises such as business letters and resumé writing in English classes; using job-related examples from carpentry, machining, electronics, and other occupational areas in math classes; investigating occupations and the occupational composition of different states or countries in social studies classes; and examining the implications of biology for health workers, of electricity for electronics and computer occupations, and of physics for the design of machines. Such informal efforts to get academic teachers to modify the material they teach

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[21] For corroboration on this point, based on a review of the available literature, see Plihal (1990).

[22] There is an obvious symmetry between Model 3, introducing more "vocational" material into academic courses, and Model 1, introducing more "academic" material into vocational courses. However, we have not seen an analogue to Model 2, in which vocational teachers are used to suffuse what are otherwise academic courses with more occupationally relevant materials. Examples might include putting vocational and academic teachers in teams to teach applied academic courses, or assigning vocational teachers to groups of math, science, or social studies teachers to help them develop occupationally realistic illustrations.

is relatively rare, except in the context of more comprehensive efforts to integrate vocational and academic education, particularly those described in Models 4 and 7.

Indeed, there are good reasons to think that an informal approach to suffusing vocationally relevant material with the academic curriculum would probably fail. This approach is reminiscent of career education, a movement which emerged in the early 1970s (Marland, 1974). In its original form, career education set itself the task of reshaping the entire curriculum around careers at every level from kindergarten through grade twelve. It proposed using information about occupations to introduce students to what careers are like, including examples from the workplace in math, social studies, and science classes, and to provide all students with marketable skills by the time they left high school. For a brief while, career education attracted a great deal of support; it then collapsed as quickly as it sprang up, leaving behind only the course in career education which some high schools offer to provide students with occupational information. But the ambition of career education to reshape the entire schooling system has left no traces: Such a task was too difficult to accomplish through exhortation alone; the constant application of material about careers often seemed both contrived and trivial, and the movement offended those who saw schools as having purposes other than vocational ones (Grubb & Lazerson, 1975; Cohen & McGowan, 1977; Farrar, deSanctis, & Cowden, 1980). Reshaping the high school curriculum through informal means—through jawboning and exhortation—is nearly impossible under any circumstances, and to do so where there would be resistance from academic teachers guarding their traditional content and methods would be beyond imagining.

A more promising approach to incorporating more vocational material into the academic curriculum has been to introduce new courses—particularly the so-called "applied academics" courses. Indeed, this is the most common approach to integrating vocational and academic education.[23] There are three widely used applied academics courses:

- Principles of Technology (PT), an applied physics course within the first year curriculum, presents material about various physical principles (e.g., force, work, rate, resistance, energy, power, and force transformers) as they relate to four

[23] For example, of the twenty-six states responding to Losh, Border, and Bishop (1988) that were doing something to integrate vocational and academic education, sixteen claimed to be introducing one or more of the applied academics curricula.

energy systems—mechanical, fluid, electrical, and thermal. It is a lab-based, "hands-on" course, with applications both in labs and textbook material drawn from occupations that use any of the energy systems.

- Applied Mathematics presents a series of topics drawn from arithmetic ("Measuring in English and Metric Units"), algebra ("Using Formulas to Solve Problems"), geometry ("Right-Angle Relationships" and "Working with Shapes in Three Dimensions"), trigonometry (the last module is "Trigonometric Functions"), statistics (including frequencies, means, medians, modes, and standard deviations), probabilities, and other skills such as problem-solving techniques and estimation. Each of the twenty-two modules is introduced with a videotape which relates the mathematics within that module to workplaces, and examples and problems are drawn from various occupations.

- Applied Communication is a course in communications skills, both written and oral, as well as interpersonal relations and some job-search skills; its modules cover topics such as "Communicating with Co-Workers," "Communicating with Supervisors," and "Communicating with Clients and Customers"; "Gathering and Using Information in the Workplace"; "Following and Giving Directions"; "Evaluating Performance"; "Starting a New Job" and "Upgrading, Retraining, and Changing Jobs." Each module has sections that are specific to one of five occupational clusters: health occupations, business and marketing, agriculture, technical/trade/industrial occupations, and home economics.

While these are the dominant applied academics courses, others have been developed. An applied course in biology and chemistry is being developed, and Applied Mathematics II is being planned. The state of Georgia has developed a vocationally applied mathematics course, and Battelle Pacific Northwest Lab has developed a course in materials science and technology, with the support of the U.S. Department of Energy and its labs, which is now being tested in Washington and Oregon. Materials Science, which grew out of the need to train more materials technicians and engineers, combines the chemistry, physics, and electronics required in the analysis and development of complex materials, along with production techniques such as molding and casting. Indeed, the course is so interdisciplinary that pilot schools report the greatest successes are those that have combined a science teacher with a vocational instructor. The curriculum materials include

articles from technology manuals and magazines as well as text material, partly to keep up with fast-moving developments. Teachers describe the course as more "hands-on" and interdisciplinary than conventional academic science courses, and labs are important components (though several schools have experienced problems in starting their labs). However—unlike conventional science labs, where there is always an unambiguously correct answer which students are supposed to get, and, therefore, no real experimentation—the labs in Materials Science and Technology can be truly experimental: Students can make materials whose properties they (and the instructors) don't know, and instructionally useful "failures" come up because the labs are not the precisely codified exercises of conventional academic science. In the process, students need to use the methods of science—hypothesis-formation, searching among alternative solutions, problem-solving analogizing—and the attributes of inquisitiveness and precision. The contrast with Principles of Technology is particularly instructive: Instructors report that PT labs must be precisely set up, or the answers turn out incorrectly, confusing students and destroying the lab's educational value. Labs may appear to be "hands-on" forms of learning, then, but some are routine, while others have much greater educational value.

The use schools make of applied academics courses varies enormously. In one "academy," described below, Principles of Technology forms the core of the school, and is used to motivate and organize the teaching of math, English, and science. In this particular case, the PT curriculum has been extensively modified, though in most other applications we saw, it has been used as a package. In some schools, PT is intended to be taken in place of physics or general science by those students enrolled in vocational programs (including those enrolled in area vocational schools) as a lab science course better related to vocational content. In these cases, Principles of Technology has a clear place within a sequence of courses, and is clearly related to vocational coursework.

Similarly, Applied Mathematics and Applied Communication are used in different ways. Often, academic teachers will select individual modules to teach specific skills which their students need; this is particularly true of the communications skills in Applied Communication, which are not explicitly taught elsewhere in the high school curriculum. In such cases, teachers tend to view Applied Communication not as a substitute for English courses, but as a complement with vocational relevance. In Oregon, for example, Applied Communication has been accepted as supplemental curriculum for business and English in all schools. South Carolina has synthesized Applied Communication with literature units

(half in British literature and half in American literature), again formulating a hybrid course. At various schools, teachers select modules from Applied Mathematics to teach or to reinforce specific skills. In some schools, Applied Mathematics and Communication have been substituted for general math and lower-track English courses for students in vocational programs, or individual modules from these courses are used with students in vocational programs. In these cases, there has been an explicit effort to link the applied academics courses to vocational programs so that there is some sensible sequence of vocational and academic courses.

In Oregon and Washington, the applied academics courses have been widely used, but almost always with local modification. For example, teachers have brought in supplementary materials and replaced parts of the standard curricula; when this happens for a few years, the result is a course quite different from the original. In teaching Principles of Technology, some teachers have taught math when necessary as the course proceeds (rather than requiring a math prerequisite), and others have adopted computer programs to supplement the course. In one Oregon school, Principles of Technology has been adapted for special education students as a way of bringing science to individuals who would otherwise take no science courses at all. In these cases, the applied academics curricula provide starting places or ideas for teachers to modify, but the final results may look nothing like the standard curricula.

Sometimes, however, Applied Mathematics and Applied Communication are used "off the shelf" (without any modification) simply as remedial courses.[24] In this form, they may be used for either vocational or general-track students. One school we visited used all three applied academics courses for remediation aimed at students in the general track; however, the principal—who wants to increase college placements and virtually remove vocational education from the high school—has thwarted the efforts of the site coordinator to increase students' commitments to vocational education through applied academics courses. When applied academics courses are explicitly used for remediation, the responses of teachers are sometimes tinged with demeaning attitudes; some report that they

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[24] However, very few teachers have ever suggested that Principles of Technology might be considered a remedial course. It is generally regarded as a rigorous course at about the level of a standard high school physics course, and, in the estimation of most teachers, it requires at least Algebra I. The labs, which use a good deal of specialized equipment, the main expenditure necessary for the course, strike us as relatively sophisticated. There is also a second year of Principles of Technology, so the entire sequence is quite extensive.

are pleased with applied academics courses because they are better suited to the lower ability levels of vocational (or general-track) students, or more appropriate to the "concrete learning styles" they assume these students have.

In still other schools, the applied academics courses are offered "off the shelf" as electives, joining the crowded and incoherent schedule of the shopping mall high school. In such cases, large numbers of students from the general track appear to take applied academic courses in place of general science, general math (or consumer math), and watered-down literature courses. Such a practice may be positive because it replaces general-track courses of little content with more substantial courses that relate academic material to future vocations, but it also destroys the link between the vocational programs and applied academics courses. This practice, therefore, limits the integration of vocational and academic material to individual courses, rather than linking courses across a coherent program. In addition, college-bound students rarely show up in these applied academics courses, so there is little opportunity to integrate the tracks of the differentiated high school.

The style of teaching these courses also varies substantially. Labs are a crucial part of Principles of Technology, and provide an important activity-based component of the course. When labs are used as intended, groups of four students work together on all projects in a form of collaborative learning. Even in the case of PT, with its elaborate lab, it is possible to convert the course into one that looks highly "academic": In one lab we observed—one in which students were to use strobe lights to measure the rate of revolution of a motor—the instructor decided not to let students use the strobes, and, instead, demonstrated the experiment to the class while the majority looked on in evident boredom and incomprehension. Both Applied Mathematics and Applied Communication have suggested exercises, akin to labs or vocational workshops, and the material of these courses lends itself to role-playing, oral presentations, and exercises in group decision making. In one high school, for example, an English teacher had selected certain modules of Applied Communication for her twelfth grade classes, enriching the usual discussions of literary material with problem-solving strategies, oral presentations of particular points of view, group participation, performance evaluation, and interpersonal conflict management drawn from these modules. In another school, teachers had introduced labs into Applied Mathematics in the form of projects in which concepts of the course could be investigated. Teachers need not develop these kinds of participatory or activity-based exercises, however, so Applied Mathematics and Applied Communication often look like

conventional academic courses—teacher-directed, with workbook exercises and drills—even though their subjects are chosen for vocational importance and occupational examples are used consistently.

In many states, the applied academics courses count toward graduation requirements in science, math, and English, though to do so they typically must be taught by teachers certified in these subjects. As a result, the majority of instructors are academic teachers rather than vocational teachers.[25] Although many instructors acknowledge that team teaching with both vocational and academic instructors would be an improvement, the reluctance of administrators to double the resources per class has made this practice rare. The dominance of academic teachers may reinforce a tendency for such classes to be more "academic" in tone and method than might be the case if vocational instructors taught them, and it certainly precludes any integration of vocational and academic faculties.

Why have the applied academics courses become the most common approach to integration? One reason is simply that most teachers enjoy teaching these courses, and they appreciate the effort to incorporate vocationally relevant material. Another is that many teachers look for readily available curriculum materials, and the existing applied academics curricula are the only widely available alternatives that teachers can use "off the shelf." There is a practical reason for ready-made curricula: Secondary teachers are badly overworked. Most of them teach at least five classes a day of perhaps thirty students, with enormous amounts of time required outside of class for correcting essays and problem sets, setting up labs, and fulfilling reporting requirements. Few of them have any time or appetite for curriculum development at the end of a long day, and many districts have been unwilling to set aside time and resources for teachers to develop their own curricula. But there are still deeper reasons for the desire to use curricula "off the shelf." Individual teachers rarely have the mix of abilities and backgrounds to develop their own interdisciplinary curricula, and almost none of them have training and experience in both vocational and academic subjects; the institutional division between vocational and academic education has its counterpart in teacher training programs, too. Moreover, in

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[25] These observations are based on our visits to applied academics classrooms, rather than on any systematic survey. A notable exception we observed is an area vocational center in Alabama, where an ambitious electronics teacher has special permission to teach PT for science credit. Research by Jerry Pepple of the University of Illinois, sponsored by the NCRVE, will examine a sample of applied academics classes in Illinois and generate more systematic information about teachers, students, and practices in these courses.

some districts, administrators assert that teachers should not develop their own curricula; they view teachers as individuals who implement materials developed by others, rather than as people with the time and ability to devise new courses. This attitude reinforces the need for prepared curricula and—compared to the range of teacher-developed curricula that we saw in the Ohio schools, in the Smithville Area Vocational Center, in the academies described below, and in some schools that have adopted occupational clusters—considerably limits the possible approaches to integration. Further efforts to integrate vocational and academic education, therefore, need to consider teacher training and the dominant conceptions of what teachers do.

The existing applied academics courses and other efforts bending the academic curriculum toward greater vocational relevance have real promise, then, particularly in giving academic subjects a more applied context, one clearly related to students' futures. This approach also allows for coherent sequencing of courses when applied academics courses are linked to particular vocational programs. However, this approach has a limitation analogous to that of the two previous models: It changes academic courses and leaves vocational programs untouched. In many cases, this approach has failed to encourage cooperation between vocational and academic teachers, since academic teachers can use applied academics packages "off the shelf" without consulting any other teachers. In addition, applied academics courses have sometimes become remedial programs or electives without clear purpose, rather than being linked to vocational programs. Therefore, integrating vocational and academic education is an activity which ought to consider *sequences of courses*, rather than individual courses—an aspect of high school which the next three models address.

Model 4: Curricular "Alignment": Modifying Both Vocational and Academic Courses

Still another approach to integrating vocational and academic education has been to change the content of both vocational and academic courses—using more occupationally relevant material in academic courses and more academic or basic education in vocational courses—and then to link the two. We refer to this approach as curricular "alignment"

because the content of vocational and academic courses is coordinated or "aligned."[26] This model is highly flexible, with many possible variations. It is also potentially low in cost because it stresses coordination of existing teachers and courses, rather than additions or complex reconfigurations of high schools.

The extent of coordination and the nature of links among courses can vary substantially, of course. In some schools, vocational and academic instructors have planned jointly so that students are learning about similar subjects at the same time in both vocational and academic courses—what we might term "horizontal alignment" because the crucial linkage exists across courses at the same time. For example, vocational courses can present problems to be solved, motivating their examination in academic courses, which in turn provides the general competencies for successful solution of the original problem back in the vocational courses. In one school, an industrial arts teacher and a math teacher have joined forces so that the mathematical topics required in various forms of production—including measurement, area, volume, the algebra associated with electricity and heat transfer, and simple trigonometry—are taught at the same time as they are needed for a series of workshop exercises. In another example, a drafting and a geometry teacher have coordinated their courses. The drafting teacher reserves one section of Drafting I for students who agree to take geometry, using the vocational class to lure students into additional mathematics; then he uses geometry extensively in the drafting class. In a similar case involving three teachers, six schools have initiated a program sponsored by Northern Illinois University, in which courses in electronics, physics, and math are coordinated. As in the drafting/geometry example, electronics and a complete television studio are the hooks to enroll students who would not ordinarily take science and math. In this example, math and electronics are used to support the teaching of physics, but the emphasis of the integrated program could depend on the interests of the teachers and students involved. The parallel teaching of similar topics by a vocational and an academic teacher in the Smithville Area Vocational Center is another example of alignment.

While horizontal alignment can be carried out on a small scale, this kind of integration can involve much larger groups of teachers. One pilot site has organized seven

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[26] See also the discussion of "correlation" in Plihal (1990). She distinguishes three different approaches to correlation: a chronological-historical approach, in which two teachers present material in their courses from the same historical period on a related subject; a thematic approach, in which teachers arrange to present similar themes in different classes; and a problems approach, in which two or more classes concentrate on the same problem from different perspectives.

curriculum teams, involving about half the teachers in the school, with nine to twelve teachers per team; each team has teachers from several vocational and academic departments. The teams meet weekly to develop integrated curricula, guided by a five-year plan; in addition, groups of two or more teachers may break away from a team to develop their own forms of "alignment." Some results involve both vocational and academic teachers such as a project on international trade developed by a marketing and an English teacher, or a collaboration between the computer and Spanish teachers to develop a Spanish-language game; others, such as one integrating history and English, include academic teachers only. The curriculum teams, therefore, provide a mechanism for promoting collaboration of every kind—a formal organizational structure to promote alignment. As we will see, other models of integration (Models 6, 7, and 8) are also organizational structures which can facilitate (but not guarantee) integration of vocational and academic education.

Curriculum alignment can be quite simple and informal, involving the exchange of information on a few topics or the coordination of one or two issues within a vocational and an academic course; or it can become quite elaborate. At Bennis Tech, discussed under Model 8, teachers developed a freshman year "English/Vocational Articulation Program" which links a required vocational exploration course to freshman English. A number of "bridge assignments" have been developed to bridge the English and career courses, and vocational and academic teachers have specific responsibilities for these assignments. The program stresses library use: Students learn to use the library not only for conventional research purposes and exploration of literature, but also to find career information and develop answers to questions that come up in vocational classes. In this component, the librarian—often a peripheral figure in high schools, and almost always unseen by vocational students—becomes an active participant in coordinating "vocational" content with "academic" skills. In addition, students complete six projects related to occupations, including an interview of a person employed in some interesting position, which then serves as the basis of an oral report and a short research paper. The results of these projects are described in a notebook which is jointly graded by a vocational and an academic teacher. This complex sequence, therefore, incorporates a variety of research and communications skills, a constant sharing of issues and skills in both the English course and the career course, and a consistent collaboration between vocational and academic teachers. The school has also instituted a technical writing class for seniors, coordinated by the student with his or her capstone vocational class, which will soon be incorporated

into a senior-year project; and a drafting/geometry course is being developed in which students will take geometry and drafting in adjacent rooms in two consecutive periods, facilitating coordination of the two subjects. Evidently, once the idea of "alignment" takes hold in a school, there are many forms it can take.

The crucial element of "alignment" is that vocational and academic teachers work together to coordinate their offerings so that students experience courses that are consistent and mutually reinforcing rather than disconnected. In this approach, it would be almost impossible to use prepared curricula "off the shelf": While some modules from a course like Applied Mathematics or Applied Communication might be useful, the process of coordinating courses is so dependent on the specific topic and the predilections of teachers that local curriculum development is essential. The teachers in the Ohio Applied Academics program, for example—which can be interpreted as an exemplary case of alignment, albeit one driven by the demands of vocational programs—repeatedly emphasized the necessity of local curriculum development.

In every school we visited where teachers are cooperating in some form of alignment, the results are literally thrilling: Teachers find large numbers of unexpected parallels between vocational and academic material; the vocational teachers discover new ways to reinforce basic skills; the academic teachers discover (to their surprise) that vocational teachers have a great deal to offer in terms of content, pedagogical methods, and motivation; everyone is delighted with the chance to break down the walls among teachers; and the level of excitement and innovation is unmistakable, especially compared to the routine and humdrum of the conventional high school. With the right combination of people and sufficient resources, the process can operate quite smoothly; as a teacher in one of the California academies declared, "Alignment is easy; it just takes time."

A different kind of alignment involves a coherent sequence of vocational and academic courses, in which content is again modified to include more "academic" material in vocational courses and vice versa. We might term this "vertical alignment" because the crucial coordination takes place over time, rather than (or in addition to) across courses at the same time. One variant of this approach has emerged in several southeastern schools, members of the Southern Regional Education Board (SREB) consortium. In one example, in a region we will call Seward County, eighth graders take a state-developed course called "Introduction to Technology," which presents them with information and lab exercises

about new technologies (e.g., lasers, robotics, and computer-driven production processes) in four broad industrial clusters: transportation, communications, power, and energy. The course is intended both to introduce students to modern technologies and to give them some sense of what different occupations are like, so they can then make more informed decisions about their high school curricula in ninth grade.[27] Those choosing relatively technical vocational programs then take Algebra I in the ninth grade to prepare them for Principles of Technology in the tenth grade (in place of the general science courses usually dumped on non-college-bound students). This precedes a vocational program such as electronics, machining, or drafting in the Seward Area Vocational Center, which normally takes up a half of each day for junior and senior years. During these two years, these vocational students are likely to take Applied Mathematics and Applied Communication in place of general math and non-college English (though, in fact, many students, having completed Algebra I and PT, continue in the conventional math sequence, particularly those in machining, which requires more trigonometry). At the same time that certain courses in the home high schools are modified to be more relevant to vocational students, the director of the area vocational school is pressuring his teachers to set aside more time to reinforce academic content, including reading comprehension, technical writing, and related math, and to require more papers and essay exams. Each workshop has an area set aside as a classroom, in some cases with a wide range of books related to that occupation; and the area vocational school includes an academic teacher who spends most of her time on

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27 "Introduction to Technology" can be interpreted as an updating of the traditional shop course, substituting modern techniques for the woodworking and metalworking of the nineteenth century that dominated the old shop course—derisively named the "bird house and gun rack" approach by one instructor. In addition, the course contains important elements of career education, systematically illustrating different occupations and their connections to new technologies. A number of states and localities appear to have devised such a course, to be taken sometime during eighth or ninth grade preceding the selection of a program for high school. Another example is Mississippi's Diversified Technology, a "technical literacy course for students pursuing 'high tech' careers," which introduces students to systems theory, microcomputers, robotics, computer numerical control techniques, programmable controllers, computer-aided design, lasers, and mechanical, fluid, electrical, and thermal systems. Four of the nineteen modules also address "work life skills" such as technical communication, time management, group work, leadership, and entrepreneurship. New York has developed Introduction to Technology, required by the end of eighth grade, stressing technological systems, related math and science concepts, some social implications of technology, and career-related information; see Adelman's (1989) description of the New York statewide initiative.

However, as in all cases, there may be a substantial difference between the potential of "Industrial Technology" and its actual implementation. In one school we observed, the instructor treated this course as an elective alongside the other electives of the shopping mall high school, rather than as a course in a particular sequence; most of the students were tenth and eleventh graders, not younger students contemplating future courses and occupational choices, and not students bound for vocational programs. Worst of all, the course was taught as a form of light entertainment with students developing pictures, building model cars and rockets, and engaging in other fun stuff—a lull in the midst of the school day.

remediation, but is also available to consult with vocational teachers about academic material they might incorporate.[28] In a sense this approach incorporates elements from both Models 2 and 3, modifying both the vocational and academic sides of the curriculum. The crucial shift is the attempt to create a coherent sequence of courses for students electing the vocational program, rather than modifying individual courses that remain independent of each other.

There are, of course, limitations to "vertical alignment." The Seward changes principally affect vocational students, and leave the sequence of academic courses largely unchanged; there has been little effort to integrate vocational and academic students; and the structure of the schools in Seward County—with an area vocational school distinct from "academic" feeder high schools—makes regular contact between vocational and academic teachers difficult. However, the great strength of this approach is that it conceives of integration at the level of a high school *program*, rather than at the level of an individual *course*.

The next four models also have modified entire sequences of courses. Indeed, they can be considered examples of organizational structures which facilitate alignment, both horizontal and vertical.

Model 5: The Senior Project As a Form of Integration

The efforts at integration presented so far begin with conventional vocational and academic courses and programs, and then develop ways of pushing one toward the other. An alternative to structuring teaching around courses and course sequences—a tradition that has been in eclipse since the 1930s—has been the project method, organizing the curriculum around student projects which serve as the basis for teaching material from the

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[28] This case is a good example in which we have had to construct a model based on fragments of practice. The director of the area vocational school has an extraordinarily clear vision of what he would like to accomplish, but he has to work with four feeder high schools, some of them indifferent to vocational students and unenthusiastic about modifying their programs to fit the model. In practice, only small parts of the vision are in place, and some of them have been misinterpreted by teachers or simply undermined by incompetent teaching. We will return to the problems of getting the consistent support of principals, school boards, and faculty for any innovation in the fourth section of this report.

conventional vocational and academic disciplines.[29] To be sure, many teachers—especially vocational teachers—use a series of small-scale projects to develop increasingly sophisticated skills; electronics, machining, and welding classes, for example, often present students with projects of increasing complexity that students complete relatively independently; a common project in carpentry or construction programs is to build a house. However, such projects are typically confined to individual courses rather than encompassing capacities learned in many different classes.

When properly implemented, the project method may be an ideal alternative (or supplement) to other forms of integration because it allows students to integrate material from very different courses and disciplines, and it allows for the greatest individualization. A few schools have started using senior projects in this way. One partial example is the senior project at Bennis Tech, though this appears to be used more as a capstone to a vocational sequence than as a way of integrating materials from different parts of the curriculum. In several other schools, however, the senior project has become a way of forcing students to master a variety of competencies. In one school, for example, each student's project consists of a written report, a physical representation of some kind—requiring the use of vocational shops in most cases—and, finally, an oral presentation; the principal claims that the need to prepare for the senior project has forced teachers to include the capacities necessary for such independent work. Two other schools—both of them magnet schools, one in science and technology, the other in engineering and computers—have explicitly restructured their programs to prepare students for the senior project. In one case, a freshman course in technology was redesigned to focus on six to seven problems, introducing students to ways of developing and resolving the kinds of problems they might encounter in their senior projects; the curriculum of individual courses was modified so that students would have better problem-solving skills and some experience in each of the sophisticated labs that they might need for their senior project.[30] In another school which instituted a senior project, teachers found that students were unprepared to work

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[29] For the history of the project method, see Kliebard (1986), Ch. 6. The project method is interesting, partly because its origins drew upon both John Dewey, who opposed many aspects of vocational education, and David Snedden, who was associated with the movement for vocational education.

[30] In this school, the labs are generally quite sophisticated; they include life sciences and biotechnology, computer systems, energy and engineering, prototyping and engineering materials, telecommunications, engineering graphics and computer drawing, microelectronics, robotics and industrial automation, chemical analysis, optics and modern physics, and television production. They are, therefore, quite different from the workshops in machining, automobile repair, and carpentry most often found in vocational education. This school is also a highly selective magnet oriented to college preparation.

independently on their projects; they then identified the skills necessary for successful completion of a project, and went back through the curriculum to incorporate these skills. In addition, students are taught techniques for research, experimentation, and problem-solving during ninth and tenth grades in preparation for their projects.

One common development in the schools with senior projects is that the project becomes a catalyst for many other curricular changes, particularly as teachers realize that students lack the skills for independent work and problem solving. The extent of curriculum changes in response to these discoveries varies widely, however, from efforts of individual teachers to modify conventional courses, to more thorough efforts to restructure ninth and tenth grade courses and to provide early exposure to the labs that students will need for their projects. In addition, the educational emphasis in all these schools is to develop certain capacities not conventionally taught, including the ability to work independently, to solve problems, and then to present results and findings to others; the effects of senior projects on integrating different courses is incidental. Finally, projects in these schools can have an occupational emphasis, though they need not. Particularly in the two magnet schools that see themselves as college preparatory, projects chosen may have a more "academic" or research-oriented cast to them. The project method is, therefore, not necessarily an adequate approach to integrating vocational and academic education, since its effects on integration may be small and its vocational content may be nil. However, as an impetus for getting teachers to collaborate and as a part of a school which has attempted in other ways to develop integrated curricula, a senior project seems to have real promise.

Model 6: The Academy Model

Among the innovations described in this paper, the Academy Model is among the best established. Academies began in Philadelphia, which now has seven academies in electronics, business, automotive and mechanical sciences, and health (as described in Snyder & McMullan, 1987). The approach was adopted with private funds in a few schools south of San Francisco, and then spread throughout California with the help of state revenues. There are now twenty-seven publicly funded academies in California in subjects which include health, electronics, computers, agriculture, business, and media,

and thirteen more are being planned. Several others operate without special public funding, some of which are quite different: One is a technology academy, using Principles of Technology as the core; another is a teacher academy, intended to encourage more students to go into teaching. American Express has supported a series of twenty-four finance academies, which focus on preparing students to go into occupations related to financial services. Ideas for new kinds of academies keep cropping up: There are academies in the planning stages in law and government, pre-engineering, and tourism, for example. Evidently, the range of vocations for which academies have been started is quite broad.

Academies usually operate as schools-within-schools.[31] Typically, four teachers collaborate in an academy, one in math, one in English, one in science, and one in the vocational subject that is the core of the academy. Each class of students takes all four subjects from these teachers (known as block rostering), and they stay with the same teachers for two or three years. Other subjects—social studies, history, foreign languages, and other electives—are taken in the "regular" high school outside the academy structure. One essential element of the Academy Model, then, is that a group of teachers works with one group of students and with each other consistently over a period of years. The opportunities for coordinating their courses—that is, for horizontal alignment—are substantial, and, because each academy is focused on a cluster of occupations, it becomes relatively easy to integrate vocationally relevant material into academic courses. For example, the English teacher can present vocabulary related to that occupation and read stories about individuals in the occupation and technical manuals in reading instruction; writing exercises can focus on the kinds of writing typical of the occupation. Similarly, math and science teachers can coordinate the order and nature of their topics to suit the pace of the vocational course, and the vocational instructor can count on certain topics having been previously covered. The regular meetings of these teachers also help identify particular problems that students are having—for example, with a particular algebraic formulation, with measurement, or with certain types of oral communication—and then the solution can be developed and assigned either to a specific teacher or to several teachers for reinforcement. Teachers also develop special projects which cut across all four classes; for example, an electronics academy we visited was in the process of developing a unit on

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[31] Some academies operate within magnet schools. The High Technology Magnet program, within the Schenley High School Teacher Center in Pittsburgh (described in Adelman, 1989), appears to be structured much like an academy: It is relatively small; it focuses on a single vocational subject (electronics); and it has involved a great deal of teacher collaboration in the development of the curriculum. It is not formally an academy, however.

telephones in which the electronics class would study the electronics of telephones and build phones; the science class would examine the basic electrical theory underlying telephones as well as the physics underlying newer forms of voice transmission (via satellite and optical fiber networks); the math class would examine the arithmetic of phone bills and phone charges; and the English class would practice phone conversations to understand the differences between speech over the telephone and speech in face-to-face interactions.[32]

A second element essential to the Academy Model is the development of relationships with firms operating in the occupational area of the academy. Thus, the electronics and computer academies located in Silicon Valley have established ties with high-tech firms; a health academy is located near a confluence of hospitals; a technology academy has established good relationships with a high-tech engineering and manufacturing company; and the finance academies use their connection with American Express. The firms provide mentors to all students, send individuals to talk on particular aspects of their operations, provide tours of their facilities, and offer summer internships for students; thus, there are regular contacts, both individual and throughout the academy, between firms and students, and other sources of instruction and motivation (cognitive, behavioral, and financial) in addition to that provided by teachers. The contact with firms makes the academies real in a sense that conventional high schools are not, providing a context for instruction that even a well-equipped vocational program cannot offer.

Most academies have been designed to motivate students who might otherwise drop out of high school. The selection procedures typically eliminate students who are clearly college-bound and identify students who appear to be performing below their potential and earning low grades. However, students with serious behavioral problems and those whose motivation seems deficient are often not included; many academies have more applicants than they can accept, enabling them to choose the students they think can benefit the most. With this population of students, there is substantial evidence that the academies reduce dropout rates, and they appear to increase enrollment in postsecondary education (Stern,

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[32] This is another example in which the content of English classes associated with vocational classes emphasizes communications skills rather than literature, as does the Applied Communication course. In this particular case, the teachers' discovery that their students had difficulty communicating on the phone was the origin of the phone unit.

Dayton, Paik, Weisberg, & Evans, 1988; Stern, Dayton, Paik, & Weisberg, 1989).[33] A few academies have not emphasized students likely to drop out, however: For example, one technology academy has decided to select students in the middle or high-middle of the distributions of ability and achievement, but who want a less abstract form of instruction than the conventional college preparatory track.

The Academy Model has many clear advantages compared to the high schools within which they exist. They have smaller class sizes, and, therefore, higher teacher-pupil ratios; the teachers teach fewer classes in order to have more time for preparation and meeting with other academy teachers. Students have more sustained contact with their teachers than most high school students, who may have thirty of more teachers during their last three years of high school; teachers come to know their students and their individual problems and strengths much better than other high school teachers can. The teachers are self-selected, and, therefore, highly committed to the Academy Model. The scale of the academies is relatively small, contrasting sharply with the chaos and anonymity of large high schools. The connection with firms provides additional motivation and other forms of instruction, as well as the lure of summer internships and post-high school employment. Thus, the benefits are substantial quite apart from any opportunities to integrate vocational and academic education. In addition, the basic academy structure provides substantial opportunity for both horizontal alignment, as teachers coordinate the topics they teach, and vertical alignment, since teachers stay with a group of students for two or three years and can adjust the sequence of topics over time. In our observations, the faculty in some academies spend a great deal of time together both developing curricula and coordinating their individual courses, and discussing the progress of individual students. The structure of the academies, thereby, facilitates collective responsibility for student achievement, something which is usually missing in the high school.

If we see any limitation to the Academy Model, it is the tendency to segregate students in virtually the same ways that tracking does. The focus of most academies on

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[33] In this evaluation—the only substantial evaluation of any innovation described in this paper—the control group included students in the general track in the same high schools with grades similar to those of academy students. Unfortunately and unavoidably, this design cannot guard against the possibility that the selection mechanisms of the academies—their choice of the most motivated students among their applicants—explains the positive effects. However, we have few real doubts that academies—*if* implemented as designed—are more effective than the high schools in which they are located; they have so many important elements that it would be surprising if they were not so.

potential dropouts means that their students don't mingle with college-bound students; because they are selected on the basis of their academic records, academy students are more likely to have relatively low aspirations, to be minority students, or to be from lower-class backgrounds. As a result, the teachers in the academies must confront the presumed academic deficiencies of their students. In some cases, academy teachers presume that their students are slow learners, and reduce the demands on them accordingly, by slowing down the conventional math sequence or the usual topics taught in a vocational course, by reducing the sophistication of a science course, or by replacing sophisticated writing exercises in English courses with practice in writing business letters.[34] In addition, within some schools, the academies are viewed as the place for "at risk" or low-ability students—though that stigma is sometimes tinged with envy of the additional resources available to academies. This kind of response has not taken place, in our observation, in those academies which have selected their students from the middle of the distribution of academic performance, so these academies vary markedly in the tone in which faculty discuss students.

Unfortunately, some schools which call themselves academies have abandoned (or failed to adopt) some important principles underlying the academies. Some have lost funding for small class sizes, and others have weak links with employers. In several academies we visited, there is little cooperation among teachers; in such cases, an academy looks very similar to a conventional high school program except that a group of students is block rostered. In other cases, the cooperation among teachers extends only to identifying problems students are having, but each one teaches his or her class independently with little effort to coordinate or "align." The crucial point—one which applies to the next two models as well—is that the academy structure can *facilitate* the coordination of vocational and academic education, but structure alone cannot *guarantee* that cooperation takes place.

With all their splendid features, why aren't there more academies? In most schools, one academy of perhaps eighty students exists within a high school of fifteen hundred to

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[34] Of course, these responses to students whose academic performance is mediocre take place in the rest of the high school, especially in the general track where most academy students would otherwise be, so there is no reason to think that academy teachers behave any differently than other teachers. Still, potential benefits of integrating vocational and academic education are to eliminate the segregation which pervades the high school and to shift the basis of evaluating students away from conventional academic performance to more complex, and ultimately more realistic, conceptions of performance. The academies have developed a structure where this could be possible, though most have not done so.

three thousand students, so the academy influences very few students. Instead, one could imagine high schools organized with a large number of academies so that every student enrolls in one—a way to combat the size, anonymity, and "milling around" of the typical high school. One simple answer is cost: The smaller classes, release time for teachers to collaborate, and time to establish relationships with firms and mentors represent substantial resources, amounting to an additional $1,000 per student in schools that might otherwise be spending roughly $3,500 to $4,000.[35] Another is that the Academy Model breaks the standard practice of the high school—in the intense collaboration required of teachers, in breaking down the barriers among disciplines, in inviting "outsiders" such as firms into the inner workings of schools, and in their requirements for block rostering—that discomfit many teachers and administrators.[36] Perhaps because academies are rather different, they also seem to require individuals with commitment, energy, and organizational skill to spearhead each one—a kind of leadership which has been evident in many of the efforts to integrate vocational and academic education, but which is still comparatively rare.

Model 7: Occupational High Schools and Magnet Schools

In some cities, occupational high schools emphasizing preparation for clusters of related vocations exist. These include schools such as Aviation High School, the High School of Fashion Industries, and the Murry Bergtraum High School for Business Careers in New York; the Chicago High School for Agricultural Sciences (all profiled in Mitchell, Russell, & Benson, 1989); and the High School for Health Professions in Houston. Such schools are similar to the Academy Model, except that the "Academy" is schoolwide. There are obvious advantages for integration, as there are within academies: Since all academic teachers are preparing students within a single broad occupational area, the incentives to bend academic instruction toward this particular occupation are strong and the resources to do so—especially the vocational teachers with whom examples and exercises can be developed—are right at hand. Unlike many high schools dominated by the academic curriculum, the culture of such schools should more readily support integration.

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[35] Based on data in Dayton, Weisberg, and Stern (1989), the average additional cost per student in the academies evaluated was $980.

[36] However, Ohio's commitment to Applied Academics has shown that with adequate funding for release time and some self-selection of teachers, this discomfort can be overcome.

Several occupational high schools have been relatively successful at integrating vocational and academic education. In one example, an agriculture high school, there are agricultural applications in many classes; a large chart in the teachers' lounge lists what each teacher is covering in each unit and when so that teachers can readily see where there are possibilities for collaboration. The curriculum also includes courses in agribusiness, agricultural communications, food science (with a good deal of chemistry), applied biology, and other hybrids. The school is quite project centered, providing another way for different teachers to come together; some projects are included in conventional courses, while others are carried out through the Future Farmers of America as extracurricular activities. The school is relatively small—around five hundred students—and a "family" atmosphere exists among the faculty, who are quite aware that they are developing a different kind of school culture.

In another example, a health professions high school oriented to preparing students for college, the teachers are aware of the students' career goals and so incorporate health-related applications into every class. More formal mechanisms of integration also exist. All students take seven health science courses, which are more occupationally oriented (e.g., medical laboratory techniques and patient care) than conventional biology courses. A Writing Across the Curriculum program has led teachers to collaborate around writing assignments; for example, a social studies and an English teacher assigned reports on the history of medicine, and the math teacher checked calculations and statistics. The vocational curricula are revised during the summer, and some academic teachers are called in to review syllabi and consider ways to teach complementary lessons. In such institutions, integration seem natural and inevitable: As long as teachers pay attention to the goals of the school and the ambitions of the students, a great deal of integration takes place.

Most occupational high schools around the country were established some time ago, and it seems unlikely that many districts will open new ones. However, the magnet schools that many districts have opened as mechanisms of racial desegregation are similar to occupational high schools.[37] Many magnet schools have an occupational focus—in electronics, computers, or business, for example; every student within a magnet is enrolled in a similar curriculum, incorporating courses related to the magnet's focus, so that all teachers can emphasize applications in that occupational area. Just as the culture of some

[37] Some magnets operate as schools-within-schools, in which case they look more like academies; others are schoolwide, and then—if they have an occupational focus—look more like occupational high schools.

occupational high schools is distinctive, magnet schools could also develop cultures supporting cooperation in the development of curriculum. In one large city, the director of vocational education has developed a vision in which each high school would have one to three vocational specialties, similar to the occupational focus of some magnet schools, preparing students for clusters of related occupations. Students would take short courses or modules pertaining to each occupational specialty in sixth and seventh grade, then a more intensive form of career exploration focusing on fewer occupational areas in eighth grade, and, finally, elect a high school based on its occupational specialties.

Unfortunately, based on our telephone interviews and our observations so far, magnet schools do not appear to be particularly conducive to integration. In some, the vocational component is quite trivial, amounting to as little as one course per year. Others are so preoccupied with the problems of racial desegregation that curricular issues, including cooperation among teachers, have been neglected. In some sad cases, schools have been labeled magnets without making any changes. The lesson, once again, is that organizational changes that could facilitate the integration of vocational and academic education may in practice not do so. Curricular integration needs to be a clearly articulated goal, with leadership and resources devoted to it for it to take root.

Still, occupational high schools and magnet schools have real potential as ways of fostering integration. They are also excellent examples of "focus schools"—schools with clear missions, organized to pursue their educational goals and solve their own problems, innovative as the need arises, and operated with clear social contracts that establish responsibilities for teachers, students, and parents (Hill, Foster, & Gendler, 1990). As alternatives to the chaos of comprehensive high schools, addressing all needs but satisfying none, focus schools have much to commend them. An occupational emphasis is not the only way to create a focus school[38]—arts and science magnets, schools organized around environmental issues, or other problem-centered schools are obvious alternatives. Still, as long as the occupational focus is broad enough to encompass a variety of occupations and a broad spectrum of students, this approach makes a great deal of sense as a device to integrate the curriculum, to connect high school teaching to future life, and to force students to confront what they want to be when they grow up.

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[38] Note, however, that all of the public focus schools described by Hill, Foster, and Gendler (1990) are occupational high schools, with the exception of one continuation school for especially troublesome students.

Model 8: Occupational Clusters, "Career Paths," and Occupational Majors

Occupational high schools and magnet schools generally emphasize preparation for clusters of related occupations; there may be specialization within the school, but still students are prepared for a range of occupations rather than one narrowly defined job. Occupational clusters can be used within both comprehensive high schools and specialized vocational schools in ways that facilitate the integration of vocational and academic education.

A few schools have replaced conventional departments—academic departments such as English, math, and social studies, and vocational departments such as business, agriculture, and industrial arts—with departments organized along occupational lines. In one high school, which we will call Dunwood Technical High School—a magnet vocational high school in a medium-sized city—there are five departments organized around clusters of careers: agriculture, business, trade and industry, public service, and health science. Academic teachers are assigned to each department, and conventional academic departments do not exist. Each career cluster department recommends specific course sequences for a given career, from the required Career Technology course in the ninth grade—a course devoting nine weeks each to agriculture, business, trade and industry, and health science, as a way of exposing students systematically to a variety of occupations—to "capstone" courses in the junior and senior years that require job performance and are usually held at job sites away from the school.

These sequences incorporate academic classes that are "strongly recommended" as being closely related to that occupation, academic courses required for graduation, and vocational courses. For example, the "Agricultural Service and Supplies" occupation includes not only Introduction to Agriculture, Agricultural Mechanics I, and Crop Management, but also Computer Literacy, Chemistry, Business Management, and Business Communications. The intent of this organization is to provide focus and cohesion for each student: Each program has an obvious theme; the recommended course sequence reduces the "milling around" so common in high schools, and regular department meetings can focus on improving programs of study rather than—as in conventional academic departments—individual courses that are relatively independent of each other. While the integration of vocational and academic education was not a rationale for

Dunwood's structure, the teachers and administrators acknowledge that it has reduced the "territorial" conflict between vocational and academic teachers. In addition, vocational teachers have academic colleagues within their career cluster to whom they can turn if they have a problem with math or reading; academic teachers similarly have vocational teachers available for examples and materials related to the specific occupational cluster.

A similar structure was adopted in the Dauphin County Technical School, a comprehensive area vocational school near Harrisburg, Pennsylvania (for a description, see Adelman, 1989). In response to low academic achievement levels and high dropout rates, caused partly by boredom and frustration with academic courses, administrators restructured the school to establish stronger links between vocational classes and academic courses. The school eliminated conventional departments and organized faculty and students into four occupational clusters: communications and transportation, including the traditional automotive programs and machine trades as well as graphic arts and commercial art; construction, including the building trades; a service cluster, encompassing cosmetology, health, distributive education, horticulture, and food service; and a technical cluster, including chemical technology, electronics, data processing, and drafting. Each student takes vocational courses within each cluster in addition to the usual complement of academic courses required for graduation. Teachers are assigned to clusters; the academic instructors then teach students from specific clusters (e.g., tenth grade English to students in the service cluster), giving them greater opportunities to orient the content of their classes to students from a particular cluster. (This is similar to the practice in most Ohio schools adopting the Applied Academics program.)

In addition to adopting departments based on clusters, Dauphin County Technical School has worked to integrate specific academic subjects with vocational coursework. For example, the English sequence has placed greater emphasis on communications skills necessary for the workplace; a central element is a technical paper about a vocational exercise or lab sequence. The integration of math with the vocational curriculum is thought to have been comparatively easy, since technical math had been taught prior to the reorganization of Dauphin County Tech and since business math is well established. In addition, one math teacher has been assigned as a "liaison" to vocational teachers (the same role as the academic teachers serve in the Smithville Area Vocational Center). The science sequence includes Principles of Technology, as well as conventional science courses such as earth science, biology, and chemistry. In social studies, the curriculum stresses the

historical influences of work and technological advances, as well as employability skills. Tenth graders take a course on the effects of technological changes; eleventh graders take a course on the world of work and a semester of economics; and seniors take psychology and family living. There appears to have been an effort to turn the attention of the school and efforts at reform to one academic area after another, beginning with English, moving to social studies, and concentrating now on sciences. With this progression, there is a sense that all vocational subjects will eventually be integrated with academic subjects.

While departments organized along occupational lines facilitate integration of vocational and academic education, they do not ensure it. Dauphin County seems to have been successful in aligning vocational classes with academic courses, and the structure of occupational clusters—with each academic class including students from only one cluster—facilitates such integration among courses. However, this is not the case at Dunwood Tech. The vocational classes we observed were relatively conventional, with little special effort to incorporate academic material; the academic classes were relatively conventional, too; and neither the vocational nor the academic teachers showed much interest in integrating vocational and academic education, or provided any examples of new teaching methods, novel approaches, or collaboration with other teachers. The vocational teachers were mostly concerned with the large number of vocational skills that their advisory committees had approved. Those who found deficiencies in basic skills (as several reported) did not want to spend much time in remediation, nor had they joined forces with academic teachers to address the problem. The academic teachers, too, seemed more preoccupied with state-defined goals and conventional academic content than with the possibilities for integration. We do not conclude that the occupational structure of departments at Dunwood Tech is pointless; to the contrary, it has reduced "turf" battles, and the benefits in terms of devising coherent programs are substantial. However, integration at the level of *programs of study* does not guarantee that the *courses* that make up these programs are themselves integrated. Just as teachers and courses are usually independent of each other in the conventional high school, so, too, can they be independent in a high school with a very different structure. The pulls of the different academic disciplines and the various vocational areas are strong enough—particularly in a world where teacher training, textbooks and curriculum materials, and state policy have reinforced standard courses over many decades—to persist, despite the strong incentives to collaborate offered by the Dunwood occupational cluster organization.

A different approach to using occupational clusters has been developed in two schools that have retained conventional vocational and academic departments. These schools can be described as having matrix structures, with occupational clusters cutting across departments. One, which we named Landon High, is a grade ten through twelve comprehensive high school of about fifteen hundred students. In addition to conventional vocational and academic departments, six "career paths" cut across departments—agriculture and natural resources; business and marketing; art and communication; health, home, and recreation; industrial technologies and engineering; and social, human, and governmental services.[39] Each student elects a "career path" at the beginning of tenth grade. Students in a career path are urged by counselors and in brochures describing each career path to take a set of academic courses related to their paths as well as a coherent sequence of vocational courses, in addition to the academic courses required for high school graduation; in this sense, the career paths function like the occupational clusters at Dunwood Tech.[40]

Career paths at Landon seem substantial partly because they are comprehensive. The brochures describing each career path illustrate entry-level, middle-level, and professional-level occupations within each occupational cluster and typical college majors corresponding to each, clarifying that a career path is an avenue for college-bound students as well as those who intend to work directly after high school. The brochures also list the vocational and academic courses related to that path, and the very existence of career paths incorporating sophisticated vocational and serious academic courses clarifies to all students—including the college-bound—that occupations require a blend of vocational and academic capacities. Furthermore, the vocational content of each path is substantial: Landon High offers about sixty vocational courses, an extraordinarily large number for a medium-sized high school, including many advanced courses such as a third-level course in three-dimensional design and graphics; advanced manufacturing, incorporating numerically controlled milling and lathes; and a comprehensive series in agriculture (as befits a school in the middle of a farming area) with two semesters of agricultural science,

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[39] These six were created from about twenty career clusters developed by a regional higher education organization, which has put together a manual about career areas in order to facilitate articulation between community colleges and four-year colleges. The career paths, therefore, facilitate articulation with occupational programs in postsecondary education.

[40] Several vocational courses such as foods and nutrition and child development have been rewritten to count towards the science requirement, facilitating the problem of accumulating enough graduation credits while still completing a meaningful number of courses in a career path.

animal and crop science, agricultural power, and agricultural fabrication. Because career paths include a large number of vocational courses, they are much more than a new way of cataloguing academic courses.

As part of the plan at Landon High, students within each career path periodically attend something called "home room," which might be better labeled as career path activities. These include visitors from industry, profiles of occupations within the career path, tours of firms, assemblies, visits to postsecondary institutions with related programs of study, and the like. The career paths provide obvious rationales for such activities, as well as additional motivation for students; for example, because all students in the industrial technologies and engineering path have chosen that program, they are likely to pay more attention to a visitor from a high-tech firm than to visitors addressing the entire high school. The principal of Landon has developed a justification for these activities which goes beyond the usual purpose of providing students with information about occupational alternatives: They help transfer the task of motivating students and of convincing them about the need to learn both vocational and academic competencies from teachers to those outside the high school who may have greater persuasive power or moral authority.[41]

The process of selecting career paths has been carefully structured. At the beginning of tenth grade, students take an interest inventory and personality profile. Then each student sees a counselor individually to choose a career path. Thereafter, they can change their career paths at the beginning of each semester, as long as they can convince a counselor that they are doing so for good reasons; thus, choices about career paths have consequences, particularly for course selection and career path activities, but they are far from irreversible. Furthermore, counselors are responsible solely for career counseling, including advising students about career paths; disciplinary problems have been assigned to other administrators, and the personal problems—alcohol, drugs, sex, suicidal thoughts, money, and parental problems including abuse and divorce—that consume the time of many high school counselors are handled by social service organizations with offices on campus. In addition, Landon reduced its student-counselor ratio from the usual 500:1 or 600:1 to about 250:1, so there is a much better chance that counselors can provide substantial amounts of career-related information to individual students as well as groups.

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[41] In a second visit in Fall 1990, it became clear that career path activities have been difficult to devise, largely because of the lack of someone to initiate and coordinate them. This provides an illustration of how difficult it is to sustain changes that fall outside the usual course structure of the high school.

The career paths extend to teachers as well: Each teacher is a member not only of a conventional vocational or academic department, but also of a career path. Teachers in particular disciplines are spread among career paths. For example, the ten English teachers are assigned in groups of one and two to each of the six career paths; the eight social studies teachers are assigned so that three are in the social, human, and governmental services path, but each of the other five paths has a social studies teacher; the seven business teachers are spread among six paths so that only one path has two business teachers; the five industrial technology teachers are spread among career paths so that only social, human, and governmental services lacks one. Each path also has a counselor and a lead teacher who serves as convenor. Teachers then meet regularly in their career paths as well as in their conventional departments, and in these meetings discuss possible career path activities, courses, and ways to orient classes toward the occupations of career paths. The fact that every teacher has a place in the career path structure provides a ready connection to other vocational and academic teachers and a focus on a particular occupation area, facilitating cooperation across courses and the incorporation of vocationally relevant material in academic courses. These advantages are similar to those of the occupational cluster departments in Dunwood Tech; indeed, the career paths should function very much like departments except that they coexist with conventional departments. However, academic courses are not limited to students in just one career path, as they are in Dauphin County AVS; that is, each English course includes students from all career paths.[42]

In addition, teachers are constantly urged—both by the principal and, it appears, by at least some other teachers in their career paths—to integrate career-related information and applications in academic courses and to reinforce academic capacities in vocational courses. We saw numerous examples: The English courses focus on certain skills related to job-seeking such as developing personal resumés, and students also write resumés of historical or literary figures as part of the process; the food and nutrition courses and child development courses have increased academic content, and now count as science courses for graduation; the carpentry and welding classes have been revised to incorporate more math; and many agriculture courses include large amounts of plant science and soil science. In addition, several new courses have been developed. In meeting the state's requirement for an economics course, for example, students may take a conventional social science based economics class or courses in business economics, agricultural economics, or home

[42] Such an approach requires sufficient numbers of students in each career path, and is, therefore, difficult to achieve in a comparatively small high school such as Landon.

economics more appropriate for students in particular career paths. All revisions in the curriculum have been devised locally, however, with no reliance on any applied academics course or any other commercial curricula. Unlike Dunwood Tech, many teachers are highly aware of the effort to integrate vocational and academic education; an agricultural teacher who had recently arrived spoke glowingly of the "whole-school" approach to integration, contrasting it with the much more limited and serendipitous efforts in other high schools.[43]

As evidence of the pressures within Landon High, several vocational instructors (and the principal) mentioned the problem of "maintaining the integrity of the vocational curriculum." This phrase refers to the pressures to bend vocational courses in the direction of academic content while vocational instructors committed to their occupational area reassert the importance of the vocational focus. This reflects the struggle over the right balance between academic content and, more obviously, vocational skills, a struggle which has taken place in many of the efforts to integrate vocational and academic education. What is noteworthy about the matrix structure of Landon High is that a format exists—the career path meetings of faculty—in which vocational and academic teachers convene on relatively equal footing to discuss this balance, rather than leaving the mix of vocational and academic elements to each teacher without consultation with others. In our view, the tension over the vocational and academic content of courses is a welcome development, compared to the usual case in American high schools in which there is no tension or discussion because vocational and academic teachers are isolated.

The rationale for the matrix approach of Landon High provides a richer understanding of what efforts to integrate vocational and academic education might accomplish. The principal developed the career path structure as an antidote to the "shopping mall high school." Partly because of the aimlessness of high school, the dropout rate was high, and there was a great deal of teen pregnancy, frequent suicide attempts, and other indicators of alienation. Teachers were also disconnected from each

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[43] There is, not surprisingly, some variation in the attachment of teachers to career paths. Some are quite active in their career paths, while others report that the career paths made no difference to their teaching. However, even in these cases there is some ambiguity: One English teacher reported that she never paid attention to her career path, but then described teaching assignments that revealed collaboration with others teachers and activities related to career exploration. The organizational structure may, therefore, influence teachers in ways they don't recognize. It is clear, however, that the Landon "model" is far from being completely implemented.

other; the vocational faculty was especially estranged because vocational education had become a "dumping ground" and because increased graduation requirements threatened to make vocational education irrelevant. Because of his concern with the structure of the entire high school, the principal defines the criteria for success of his reforms in more complex terms than do administrators in other schools. Rather than emphasizing improvement in basic skills, reductions in dropout rates, or improvements in long-term employment—all worthy goals, to be sure—he wants to see students more aware of the purposes of schooling; better able to see the connections between school experiences and their futures; more self-motivated and better able to define paths through high school that make sense for them; and better able to establish goals, to develop plans to meet these goals, and to revise their plans as necessary. He also wants students to have a broader variety of educational experiences than is generally true of students shunted either into a conventional college-bound track, into vocational tracks, or into low-level general tracks, and to understand how the skills they learn in both vocational and academic courses apply to future work. If students have these capacities, then he asserts that lower dropout rates, high scores on the state's standardized tests, reduced truancy, and diminished problems such as pregnancy and drug abuse will follow; however, in his thinking, it is crucial to concentrate on more general capacities—ones which are, of course, harder to measure than dropout rates and test scores—rather than the more concrete consequences.

A variant of this model has developed in another magnet vocational school which we call Bennis Technical High School. Like Landon High, Bennis has retained the conventional department structure. However, students elect occupational "majors" during their junior and senior years, providing the same focus to their studies as the career paths in Landon High and the occupational clusters of Dauphin County Tech and Dunwood Polytechnic. The election of a major is preceded, in grades nine and ten, by a two-year sequence of modules that can be roughly described as extended career exploration. During freshman year, students take four nine-week modules: Communications Technology I, Electronics Technology I, Mechanical Technology I, and Manufacturing Technology I, along with Introduction to Drafting and Keyboarding; the modules include labs which teach students about basic principles and production methods and explore other aspects of particular sectors (e.g., the economics of why certain manufacturing sectors are present in some regions, but not in others). During sophomore year, students can take modules in Photography, Materials Science, Fabrication I, or Construction Technology, or they can take second-level modules in communications, electronics, mechanical technologies, or

manufacturing technologies. By the end of their sophomore year, then, every student has learned about a wide variety of technologies, sectors, and occupations.

The vocational majors which students select are oriented around clusters of occupations. As the description of the "Bennis Project" describes them, "vocational-technical curricula [are] structured to move away from a 'crafts' centered approach to a broader-based 'systems' approach." The six possible majors include communications technology, electricity/electronics technology, mechanical technology, manufacturing technology, construction technology, and drafting technology. The school also offers a health occupations program that operates as a school-within-a-school.

Within this structure, coordination and integration take many forms. The "Bennis Project," a kind of manifesto that justifies the school's organization, emphasizes the need to combine vocational and academic capabilities: "[Bennis Tech] is dedicated to producing graduates with a broad, solid base of both academic and vocational/technical skills. This base will enable [Bennis] graduates to be successful in post-high school education and employment and will provide the adaptability necessary to remain successful in a rapidly changing society." Among the specific examples of integration, one of the most elaborate is the English/Vocational Articulation Program which links the career exploration courses and English in ninth grade (described in Model 3). At the beginning of freshman year, all vocational classes spend time on measurement and measurement instruments, and these skills are reinforced at the same time in math classes.[44] The school has included Principles of Technology I and II.[45] The academic geometry class includes transformational geometry[46] because of its use in drafting and in the machine trades, and a joint course in geometry and drafting has been developed. During the senior year students can take a course in technical writing, developed by an English teacher and the chair of the drafting department; its intention, as the "Bennis Project" materials describe, is "to correlate English

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[44] Many vocational instructors have reported that students have difficulty with all kinds of measurement. We interpret this to be a problem with representing concrete objects in relatively abstract representational systems, similar to the problems we have seen with reading blueprints, electrical diagrams, and refrigerant diagrams.

[45] One section of Applied Mathematics is taught, but as a remedial course. Because of the freshman English/Vocational Articulation Project and the senior technical writing course, teachers felt that Applied Communication would be redundant.

[46] Transformational geometry studies the changes or transformations that two-dimensional figures undergo as they are projected onto non-parallel planes; there is software available to provide computer applications as well.

class writing experience and vocational cluster class experience." The school is now developing a senior project to be required of all students. In place of a course-specific project in one of a student's vocational courses or a senior research paper, the senior project combines a research paper, a vocationally oriented project ("a 'hands-on' project to display [the student's] knowledge"), and finally a speech presenting the project—a combination of "vocational," "academic," and communications skills such as the English/Vocational Articulation Project. Finally, it is common to use vocational examples in math classes, and all academic classes are supposed to emphasize technical literacy and employability skills. The culture of Bennis Tech, where students have chosen a highly regarded vocational high school with competitive admissions, affects what academic teachers do and how vocational and academic teachers interact: Integration is ubiquitous because the vocational emphasis of the school is unavoidable.[47]

There are, then, many different aspects to the reforms at Landon High and Bennis Tech, including a number of obvious advantages inherent in the matrix structure they have adopted. When career paths or occupational majors coexist with conventional departments, the following favorable results occur:

1. Students have to think early in their high school careers about their occupational futures. Then they have to make choices with some consequences—the choice of a career path, which entails certain activities but is neither overwhelming nor irreversible—and continue to reaffirm that choice or change to another career path. These decisions are more carefully supported by counseling staffs committed to career counseling and by extensive exploratory exercises in various courses than is usually the case.[48]

2. The matrix structure provides groups of related courses, shaping (or constraining) the courses students choose and imposing some coherence on the shopping mall high school. This approach, therefore, facilitates the integration of vocational and academic education at the level of the high school *program*.

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[47] The vocational emphasis at Bennis Tech is not an emphasis on a terminal education. Of the 1988 graduates, sixty-eight percent planned to go on to postsecondary education, including forty-seven percent to four-year colleges—both of these figures above the national average. The links to the local community college are especially strong.

[48] Indeed, the Landon and Dunwood examples are partly the result of a state pilot project that envisions a "comprehensive career guidance model," now being disseminated statewide.

3. The matrix structure provides teachers across disciplines a reason for meeting regularly around curriculum issues. This provides an opportunity for cooperation between vocational and academic teachers and for the "alignment" of vocational and academic courses that takes place in other models of integration—that is, integration at the level of individual *courses*. However, the matrix structure is just as effective in reducing the isolation that all teachers experience, including those within academic disciplines and even within departments.

4. Students from very different backgrounds and with varied ambitions come together in occupational clusters. The health area includes both would-be doctors and those who aspire to being practical nurses; the industrial technologies and engineering path at Landon High includes both future engineers and those who might become welders and auto mechanics.

5. The career paths provide natural opportunities and rationales for systematic contact with firms that are potential employers and postsecondary institutions that are potential next steps.

In a sense, the matrix approach of Landon High and Bennis Tech combines many elements of other models. The vocational courses certainly incorporate more academic material, as in Model 1, with the difference that academic teachers are present in each career path to provide suggestions and to help in doing so, as in Model 2. The academic courses have been made more vocationally relevant by incorporating examples from occupations and skills related to occupational search, as in Model 3. Since each career path includes sequences of related vocational and academic courses, there are natural linkages among the vocational and academic courses, as in Model 4. Each career path or occupational major looks somewhat like an academy—with every student and teacher in an "Academy" or occupational cluster and with the same potential for teachers to collaborate on curriculum and to consult with each other about students—though each is much larger than an academy. Just as academies develop close ties with firms working within their occupational area, so, too, the occupational clusters of high schools like Dunwood or Dauphin County could establish activities specific to that occupational area, including internships and mentorships with firms, tours of production facilities, and talks by managers and professionals.

Finally, one unavoidable drawback to this model should be apparent: It would not work well except in a school with a well-developed vocational program providing substantial offerings in each of the occupational clusters. Three of the four examples of this approach are area vocational schools—institutions which have concentrated resources for vocational offerings in one place—and the remaining example is a comprehensive high school that has managed to maintain a variety of vocational courses partly by using state funding for area vocational schools. This model is, therefore, unsuitable for comprehensive high schools which have lost their vocational courses.

Paths Not Taken

While the schools we have visited display an amazing variety, there are some approaches to integrating vocational and academic education which we have not yet seen or which have been only rarely mentioned. In this brief section, we outline a few practices that we expected to see but did not, or that are consistent with the models we have identified so far but have not been developed. We expect that, as schools continue to experiment with integrating vocational and academic education, different practices will continue to flourish, and we offer these ideas as ways of stimulating other possibilities for integration.

In the efforts to incorporate material from the English curriculum into vocational programs, the emphasis so far has been on "communications skills," exemplified by the Applied Communication sequence with its emphasis on reading for comprehension (as one might read a technical or instructional manual), writing in such "practical" forms as resumés and business letters, aural comprehension, and speaking abilities. The literary side of conventional English curricula has been largely neglected, though there have been very few efforts to identify literary works suitable for a "literature component" in applied communications courses. However, the potential for incorporating literature describing work—the special complexities and relationships of work, the tensions between life at work and life in other spheres, and the changing attitudes toward work—has not yet been explored in any high school we have seen.[49] One purpose of such a course would be to

[49] However, a course entitled "Working in America" has been developed at Kirkwood Community College in Iowa as part of a project on Integrating the Humanities into Vocational Education, sponsored by the National Endowment for the Humanities and the American Association of Community and Junior Colleges.

provide another perspective about work and its consequences—since the conventional approach in high school has been to stress the skills and knowledge necessary for work, but not otherwise to explore what working means in an individual's life. Another purpose would be to lead students back into literature; for the large number of students who view literature as a chore and a bore or who think of reading in purely utilitarian terms, it might be possible to use literature about work to move from purely informational uses of reading to more literary concerns.

Similarly, there have so far been very few efforts to integrate social studies, the social sciences, or history with more occupationally oriented programs or courses.[50] Again, we see considerable potential: Technological developments and their effects on economic, political, and personal life are surely important aspects of our history; the political battles over the introduction of new technologies and the consequences for different occupational groups could be incorporated into courses on government; the economic issues surrounding occupations, earnings, employment trends, and unemployment patterns should be included in any economics course. Such courses or modules could be specialized to particular occupational areas or clusters; for example, a agriculture program could concentrate on technical innovations in agriculture and on agricultural economics (and, indeed, Landon High has incorporated an agricultural economics course), while a program in business could focus on business-government relations including historic and recent battles over regulation and deregulation, macroeconomic policy and its effects on business practices, the effects of office automation (including debates about deskilling and reskilling), gender and racial segregation at different levels of business occupations, public opinion about business, and the developing international economy. Any occupational cluster could, therefore, serve as a point of departure for very general issues in history, the social sciences, and current events, "backing into" more abstract issues[51] and those which are geographically and historically more distant.

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[50] Adelman (1989) reports that Dauphin County Technical School has revised its curriculum to include the historical effects of technical change, as well as economics, psychology, and family living. A recent American Association for the Advancement of Science (AAAS) panel has also called for integrating technology education with history and social science in "integrated technology programs"; see Johnson (1989).

[51] The practice of "backing into" abstract material is quite common in some of the integration efforts we observed. In one academy, the vocational teacher observed, "We don't tell them [the students] we're going to do algebra because they're afraid of algebra; we just trick them into doing it."

In our view, the incorporation of literature, history, and the social sciences into efforts to integrate vocational and academic education is one way to counter a potential objection to these efforts: that they intend, like career education fifteen years ago, to turn high schools into wholly vocational institutions with no commitment to the political development of students, no place for the capacity to be socially critical (including the ability to evaluate the limits of existing occupations and of American capitalism generally), and no place for the exploration of values and sensibilities that comes in the humanities. To be sure, these aspects of education have been marginalized and trivialized in many high schools as it is, and the recent waves of reform—with their emphasis on international competition and beating the Japanese—have furthered the vocationalizing of the high school, even in the name of strengthening academic standards. In this context, it may be inappropriate to fault efforts to integrate vocational and academic education for similar limitations. Still, we see no need for efforts at integration to erode the political and cultural content of the high school. Indeed, we can imagine many ways in which integration could strengthen these purposes and make history, literature, and the social sciences more alive for students, while reinforcing more conventional vocational and academic competencies as well.

Finally, we have not yet seen many efforts to incorporate work experience into an integrated curriculum or to use work as a central part of integrating vocational and academic education. One exception is the Academy Model, in which summer internships are one of many activities sponsored by firms to connect each academy to firms operating in the occupational area of the academy. Also, at one agricultural high school, forty percent of students are engaged in summer long projects directly related to their school year classes. We suspect there are other ways to devise carefully structured work experience programs that might serve as a focus or a motivator for both vocational and academic instruction in the high school, or to develop a careful sequence of activities including academic instruction, vocational coursework, and in-school projects as well as work experience.[52]

There are, then, many elements in the different approaches to vocational and academic integration. Several models have elements in common such as the tendency to align vocational and academic courses, and the efforts to incorporate academic material into

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[52] David Stern and his colleagues, Charles Hopkins, Martin McMillion, and James Stone, are currently examining the efficacy of work experience programs for the NCRVE. This research will generate models of effective work experience programs.

vocational courses and occupational examples into academic courses; these courses create a structure which fosters cooperation between vocational and academic teachers and a new emphasis on guidance and counseling. (Included among these courses are ones about new technologies which simultaneously instruct students about the variety of occupations.) The specific combination of the elements varies, of course, as does the completeness with which any specific change is implemented. Therein lies the variety of efforts to integrate vocational and academic education, and the origin of our claim that there is not one approach to integration that will work for all schools.

No doubt there are other approaches to integrating vocational and academic education. The move toward integration is still in its infancy, and as educators continue to innovate, we expect to see other models develop. For the moment, it is important to think about integration flexibly and creatively, and to recognize that there are many models of integration with varied purposes and ambitions suitable for different populations and schools.

PREREQUISITES FOR INNOVATION[53]

As we have seen, there is a great deal of innovation in high schools around the country and a wealth of experience on which others can draw. Each reform and every school that has integrated its vocational and academic programs in some way represent the outcome of a complex process in which practices of long standing—some of them almost a century in the making—have been rethought and revised. This process is all too uneasily undermined: In searching for schools with some form of integration, we heard about many others whose efforts had been cut short. From the examples of successful change, as well as the unsuccessful cases, a number of prerequisites for innovation emerge. Most of them are relatively obvious, since they are requirements for educational change of any sort.

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[53] Research currently in progress by Cathy Stasz and Sue Bodilly of the RAND Corporation, supported by the NCRVE, will systematically examine the implementation of integration efforts and result in a more comprehensive report on the requirements for change to take place.

Vision, Commitment, and Leadership

Most successful efforts to integrate vocational and academic education have been started and sustained by individuals committed to a particular vision of what schooling should be. Usually they have responded to specific problems—the lack of basic academic skills required in highly technical vocational courses, for example, or the weakness of basic skills among vocational students, or the incoherence of the high school curriculum. These individuals then convince others of their vision and incorporate them in changes. It is important to recognize that, while the initial leaders can be principals, teachers can also spearhead the movement for reform. In still other cases, assistant principals rather than principals have been in charge.

Obviously, the difficulty of persuading others to follow a vision of what schools should be increases as the number and variety of individuals who need to be included expand. Curriculum "alignment" between two courses is relatively easy to accomplish because only two teachers need be involved; but schoolwide innovations are much more difficult. The hardest conditions for changing practice involve area vocational schools with feeder high schools; in these cases, not only is communication between vocational teachers in the area school and academic teachers in the high schools more difficult, but it also becomes necessary to get the cooperation of faculties in several schools with different cultures as well as different administrations and school boards. The difficulty of change in these situations is unfortunate. In many areas of the country, vocational schools are the only places where substantial amounts of vocational education—particularly the relatively sophisticated forms of vocational education such as drafting, electronics, and advanced manufacturing technologies—are still being offered at the high school level. In many comprehensive high schools there is so little vocational education that the notion of integrating vocational and academic education is difficult to imagine. [54]

We suspect that innovation is easier when it does not require extensive cooperation among teachers. Certain approaches to integration can be undertaken by teachers in isolated classrooms: Incorporating more academic instruction in existing vocational courses or teaching sections of applied academics courses requires only that individual

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[54] See, for example, the eight case studies in Grubb and McDonnell (1991). In most of these communities, vocational education has been concentrated in one site or a few centers, leaving the comprehensive high schools with little vocational education beyond typing, home economics, and perhaps an industrial arts course or two.

teachers change their practices or shift to a new curriculum. Indeed, these have been the most common forms of integration by far. However, the more meaningful and thorough approaches require that teachers collaborate with one another. In the most exciting schools we have seen, such collaboration is intense and relatively continuous, and involves both vocational and academic teachers. Such cooperation requires time, which many teachers do not have; it also requires that teachers be willing to work with one another, a pattern which is rare in schools without a supportive and cooperative teacher culture (Little, 1990). In many schools, old barriers of ignorance and distrust need to be overcome. From the schools we have visited, we are sure that such barriers can be breached: Vocational and academic teachers who have worked with one another are full of discoveries of mutual interest, of topics that both can cover, and of ways in which each can reinforce the work of the other. Cooperation can develop, then, particularly as teachers see the benefits, but the need to foster cooperation must be included in the vision of what integration between vocational and academic education entails.

It is difficult to force the changes required by various models of integration, and particularly impossible to force the collaboration among teachers and the changes in perspective required by certain approaches. In one school we visited, a dictatorial principal succeeded in forcing certain elements of the Seward model into place; he required Industrial Technology, PT, Applied Mathematics, and Applied Communication of all students going to the area vocational school, and so on the surface succeeded in implementing the model—indeed, much more quickly than the director of the Seward Area Vocational Center, who was battling to persuade principals and academic teachers of his vision. However, because the principal, operating by directive, has not communicated any change in vision to "his" teachers, and because teachers in "his" school respond largely to the principal rather than relating to each other, the changes are less substantial than they could be. The applied academics courses are taught in a highly "academic" style, with no connections to the vocational programs, and there are few visible changes in the way the area vocational school operates. The result is likely to be the incorporation of applied academics courses into the high school—a change which requires no collaboration among teachers—but without any of the other possible benefits of alignment.

One implication is that neither states nor the federal government can force the integration of vocational and academic education—at least not in its more substantial forms. In state governments and state departments of education, there are at least some who regard

the process of school reform as something that must be imposed on recalcitrant and backward-looking districts, and they tend to propose various kinds of requirements. The alternative approach, so far more common in the states we have visited, has been to fund pilot projects and provide technical assistance to local districts. This approach implicitly recognizes that states can provide some of the vision behind efforts to integrate vocational and academic education and that they can provide the resources necessary, but they cannot impose the kinds of subtle changes that many approaches to integration require. By the same token, we suspect that federal efforts to integrate vocational and academic education through the reauthorized Perkins Act will be most successful by providing a vision of integration and some of the financial and intellectual resources necessary for changes, rather than by imposing new requirements on local districts.

At the other extreme, integration will not emerge simply from casual contact between vocational and academic teachers, as worthwhile as such contacts might be. One state sponsored a set of pilot projects, allocating about $75,000 a year to ten sites to convene vocational and academic teachers in a series of monthly meetings. But nothing appears to have changed as a result;[55] evidently the contact was not sufficient, or the teachers involved were unconvinced of any need for change, or no sufficiently compelling vision of change was available. Collaboration among teachers appears to be more productive where there is a clear task to be undertaken. The Academy Model, the career paths of Landon High, the occupational majors of Bennis Tech, and the occupational cluster departments of Dauphin County AVS and Dunwood Tech all provide ample opportunity for teachers to come together around particular tasks—defining the needs of students in particular occupational areas, devising curricula, creating career path activities, and the like—which are more likely to be vehicles for productive collaboration than a set of purposeless meetings.

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[55] It is difficult to be sure of this claim because we did not visit schools in this state. However, one high school was consistently mentioned, both by those within the state and those from outside, as the one which has made the most changes because of the pilot project; yet the principal of that school discouraged us from visiting because he thought they were doing nothing special to integrate vocational and academic education. Furthermore, state-level officials cannot say what changes have taken place, suggesting that the changes have been insubstantial and that the state has made no effort to learn anything from their pilot projects for other high schools in the state (or both). We infer, then, that not much has changed.

Consistent Support from District Administrators and State Officials

In successful efforts at integration, those who have initiated change have been able to gain the cooperation of administrators—principals and district administrators who influence curriculum, the assignment of teachers, and the allocation of resources. However, in all too many cases, fledgling efforts at integration have died because administrators have been unsupportive or, more commonly, because administrators have changed and a principal enthusiastic about integration has been replaced with one who is indifferent or actively hostile. Even when teachers have a great deal of autonomy, and, thus, the ability to incorporate new materials in their individual classrooms, most models of coordination require new resources—including development time for teachers, collaboration among teachers, changes in scheduling practices, and the cooperation of counselors—all of which require the assent of administrators. Indeed, as in many other innovations, there are many individuals in a school system who can effectively veto any change, making integration efforts all too easy to undermine. This seems to be especially true in issues involving vocational education, for which there has been hostility from the academic side: Some efforts at integration have evaporated simply because new administrators have been unwilling to support vocational education in any form.

In many schools we have visited, district-level upheaval has made it impossible to maintain innovative programs. In one with several academies, but with budget crises and scandals in the central administration, two academies were combined for one year, effectively halting the development of both and generating hostility between them. Another district, on the verge of bankruptcy, began planning academies but got nowhere; another received a state pilot project for integration, which came to nothing when district budget cuts virtually eliminated vocational education. In another city, the need to racially desegregate schools converted an innovative high school into a magnet for racial desegregation purposes, and, in the process, earlier forms of curricular integration were destroyed. The turmoil in Chicago, with local boards asserting their autonomy and hiring and firing principals for many reasons unrelated to leadership abilities, may make it impossible to sustain coherent reforms or to develop a citywide reform effort like the proposal to develop occupational specialities within different schools. Clearly, some stability in district administration is necessary for curricular integration to proceed.

In some states, state-level policies add to the difficulties of innovation. Some states with stringent control over curriculum (such as Florida and South Carolina) normally require approval for any new courses taught in the high school. In such cases, innovations of any kind—but particularly the introduction of new courses such as the applied academics courses or those resulting from collaboration between vocational and academic teachers—require the cooperation of state officials. In some states, the approval of integrated courses for credit toward academic graduation requirements has been the biggest problem. In at least one state, an especially rigid conception of vocational education, including an insistence that vocational programs be relatively job-specific, has hampered the development of more general vocational courses. Stringent teacher credentialing requirements also impede integration; in particular, vocational instructors have often been prevented from teaching (or co-teaching) applied academics courses because of their lack of academic certification. Some schools we visited found their efforts slowed by the intransigence of state officials; still others complained that the vocational and academic staffs in their state departments were themselves in conflict over proposed changes. Thus, states need to consider whether their policies impede or promote innovation.

New Resources

Many models of integration involve redirecting existing resources—away from pointless courses in the general track, away from job-specific skill training in traditional vocational education, or away from the "birdhouse and gun rack" shop courses toward updated courses introducing students to new technologies and their related occupations—rather than developing new resources. Inevitably, however, innovations require some new resources. The schools we visited all had extra resources in some form or another, which they tended to use in several obvious ways:

- *Release time and preparation time*

  Teachers in integration efforts need extra preparation time, and most administrators want more free time than they can afford. Many applied academics courses require extra time, especially in the first year or two of teaching; Principles of Technology, with labs that must be carefully set up if they are to work correctly, is especially time consuming. All efforts to coordinate the teaching of vocational and academic

instructors require additional preparation time: The Smithville approach of assigning academic teachers to work with vocational programs requires additional teaching staff; the Ohio Applied Academics program allows academic teachers time to attend vocational classes; curriculum "alignment" requires time for joint planning; the Academy Model requires periods when all four academy teachers can convene; and the career paths of Landon High require initial planning time for each career path committee and then time for individual teachers to implement changes in their courses. But time is the resource in shortest supply in most high schools: The pressures to fill each teacher's day and to fill each class with the maximum number of students that can be tolerated are relentless. One measure of the scarcity of time is the absence of team teaching—even when vocational and academic teachers are cooperating and team teaching seems natural. Most principals dismiss peremptorily the possibility of team teaching because of the lack of resources.

- *Staff development*

  Many school districts have spent resources on workshops and other forms of staff development. Some of these efforts are relatively formal presentations; for example, several state colleges in the Southeast provide summer institutes for teachers of various applied academics courses. Sometimes these are much less formal: A few districts have operated summer retreats where groups of vocational and academic teachers—often those from particular departments—convene to share their experiences and devise possible ways of collaborating during the coming year. Another form of staff development is to encourage teachers to work during the summer in positions where they can develop new forms of expertise. While vocational teachers frequently do this to maintain their skills and knowledge, a relatively novel practice has been the "Teachers in Industry" program which provides opportunities for academic teachers to work during the summer as a way of understanding the requirements of employment and the uses of academic competencies in the workplace.

- *Materials*

  Some innovations require new curriculum materials and new materials for labs. Principles of Technology is a particularly expensive innovation because its labs require specialized equipment (and efforts to rig commonly available lab equipment for PT are generally judged failures). Other new curricula—such as the other

applied academics courses or the commercially available curricula which provide ways of incorporating basic skills into a vocational program—require student workbooks and teacher manuals. In general, however, the cost of new curriculum materials pales in comparison to the time costs. Of course, the vocational components of efforts to integrate vocational and academic education are expensive, a point we address below.

- *Counseling*

Several approaches to integration require more resources for career counseling. The models that stress the development of a coherent program of study, with appropriate combinations of vocational and academic courses, require that students have adequate information about which sequences make the most sense; and approaches based on occupational clusters, career paths, or occupational majors require that students be able to make informed choices. While brochures and other written material about occupational areas can be used to provide information, counselors are valuable in clarifying the importance of course sequences, developing student skills in planning and decision making, and monitoring whether students conform to their own plans. More complex activities such as research projects, library exploration, and introductory courses or modules (including those in eighth or ninth grade) provide other resources in addition to conventional counseling, and are particularly important in schools (such as Landon High and Bennis Tech) that stress students learning to make better informed decisions about their occupational futures.

The state of counseling is a subject of consistent complaint in the schools we have visited. Career counseling has all but vanished from most high schools because the all-too-few counselors are consumed with course schedules, testing, disciplinary problems, serious personal problems such as depression and drugs, and perhaps some advice to college-bound students. The vast majority of students who are not clearly bound for four-year colleges and who suffer no overt problems are unlikely to get anything but the most routine attention. Even worse, from the viewpoint of vocational teachers and those trying to develop integrated programs, most counselors are biased against activities associated with vocational education, even those who are rigorous and who open up both employment and postsecondary options. Most of those trying to integrate vocational and academic education would

like to reconstruct the counseling function within the high school, though few of them expect the resources to do so.

- *Smaller classes*

  In general, vocational courses have smaller class sizes than do academic courses, sometimes for reasons of safety. In addition, the style of teaching common in the best vocational education requires smaller classes: Teachers circulate among students working independently on projects, providing individualized guidance to students at different stages of learning, rather than addressing an entire class with a barrage of teacher talk. Several innovations we examined depend for their success on smaller classes: The Academy Model, for example, is successful partly because of the greater contact between teachers and students that smaller classes allow. In general, the incorporation of more active learning methods and more student-directed activity into academic classes requires smaller classes, and so the more elaborate approaches to integrating vocational and academic education will be most successful, we surmise, only if class sizes become smaller.

- *A rich variety of vocational courses*

  The most impressive examples of integration involve schools with well-equipped workshops, up-to-date equipment, and a rich array of vocational offerings including relatively sophisticated courses in advanced drafting, advanced computer-based manufacturing processes, and electronics; even the auto repair programs in these schools have shifted to new computer-based diagnostic systems. In these schools, the integration of vocational and academic education seems like a marriage between two equal partners. In contrast, high schools whose vocational offerings have been stripped to a few typing classes, an industrial arts class, and home economics are seriously limited in their ability to integrate vocational and academic education. Because varied and sophisticated vocational programs are expensive, several of the most impressive cases of integration take place in area vocational schools or magnet vocational schools where a city has concentrated its vocational program in one school. Certain models of integration—particularly the occupational high schools and magnets of Model 7 and the occupational cluster approach of Model 7—cannot be very successful unless vocational components are substantial, requiring resources for up-to-date equipment and materials as well as a variety of courses to fit the variety of occupational areas that students might elect.

New resources are generally used for both vocational and academic components of integrated curricula. Vocational as well as academic materials usually need change, and vocational teachers need preparation time as much as academic teachers do. Given this fact, some vocational educators have complained that the resources for integration have been contributed largely from the vocational side, including the federal Perkins funds. This criticism seems fair: Integration has as much to contribute to academic education as it does to vocational education, and resources ought to come from both sides. By the same logic, however, it would be counterproductive to restrict vocational funding for integration to vocational teachers and materials only.

Sustained Efforts

It is important not to underestimate the time required for innovations in schools, and efforts to integrate vocational and academic education are no exceptions. At one academy, in place for nine years, the director claimed that "we're still in progress." Another school began with a five-year plan and now, five years later, has decided that they shouldn't establish a specific time period for reform. They believe any period will prove too short because the nature of innovation itself shifts. In some cases, a long time is necessary because of the barriers to change; in Seward County, for example, the need to persuade principals in four feeder high schools, with four school boards and four sets of vocational and academic faculty—some dominated by older faculty resistant to change—means that a great deal of time will be necessary, perhaps even a generational shift.

Even when conditions are optimum, integration efforts take many years to establish. The innovation in Landon High is illustrative. In Year 1, a state grant allowed the school time for planning, but without much direction, the faculty wandered about dreaming about what an ideal school might look like. In Year 2, the idea of career paths emerged, and serious work took place developing each of the career paths and specifying their content. In Year 3, the career paths were instituted for sophomores, extended to juniors in Year 4 and to seniors in Year 5 (when we first visited the school). The first class with three years of experience in career paths, therefore, graduates in Year 5, but the first class to attend all three years of this high school when the career path approach has been fully operational entered as sophomores in Year 5, and graduate in Year 7 of the

innovation. Changes continue to take place, and many of the career path activities had not been fully implemented by Year 5, so institutionalization of the model might reasonably be a decade from its inception—and this in a school with a dynamic principal, a number of committed faculty, cooperation from the district administration, and financial resources from the state.

Several states have funded pilot projects to integrate vocational and academic education, often lasting three years; similarly, the consortium of states in the SREB project has also committed resources to selected schools. However, most of the successful integration efforts we observed had begun to change their programs before these pilot projects began; in effect, the pilot projects were able to piggyback on earlier changes. This means that the process of change took longer than the period of the pilot program. For a school which has not even begun to consider how it might link its vocational and academic programs, three years appears much too short.

There are, of course, more accelerated timetables imaginable for implementing reform, but the more likely scenario is that unforeseen problems will develop and administrators will change. It is important, in our view, to be reasonable about the time required for innovation. The notion that integration can take place within a year or two, or that pilot projects of two or three years' duration are adequate, strikes us as unreasonable. Rather than assuming that integration can take place quickly, we think it more appropriate to recognize that meaningful reforms will take, at a minimum, five to ten years of planning, implementation, and revision.

Teacher Training

Aside from some staff development—summer institutes for teachers of applied academics courses or summer workshops for vocational and academic teachers to devise joint curriculum—there has so far been little attention within teacher training to the efforts to integrate vocational and academic education. The gulf between the vocational and academic sides of secondary education is caused partly by differences in training. Vocational teachers often come from industry rather than from college programs, and many confess to weak academic preparation. Academic teachers have often spent their entire careers in educational institutions, and have had little contact with either the subjects of

vocational education or with workplaces in which vocational skills are used. Where there is resistance to efforts at integration, it arises as much from the backgrounds of teachers as from the lack of time and incentives to change teaching practices. Comments from English teachers about their commitment to the traditional literary canon, from math teachers about their orientation to college-prep math and its standard sequence through calculus, and from experienced vocational teachers about "the integrity of the vocational curriculum" reflect a reluctance to leave behind their training and standard curricula.

The appropriate response over the long run is to change teacher training practices—for both vocational and academic teachers. To participate more readily in integration efforts, academic teachers should be more familiar with modern production processes, the activity-based and cooperative teaching methods of good vocational programs, and the general vocational challenges which all high school students face (particularly the need to grapple with occupational choices and their educational requirements). On their side, vocational teachers may need to be better prepared in the academic subjects most important to their vocational fields. Above all, teachers of all types need to be prepared to collaborate with others and to participate actively in curriculum development, since the most promising forms of integrating vocational and academic education require cooperation in order to devise new approaches and new curriculum materials.

Another important aspect of teacher training is the induction process—the process of socializing new teachers into secondary schools. In the model programs we observed, teachers are often self-selected, or are carefully chosen for their basic sympathy with the goals of the program. Some academies, for example, select teachers who will be comfortable working closely with other teachers;[56] Landon High has begun searching for teachers sympathetic to the career path approach, and schools such as Bennis Tech with strong reputations can also choose among applicants. But even with a careful selection process, teachers and administrators comment that new teachers take a period of adjustment to novel approaches. This process can be smoothed by mentor teachers and support from

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[56] Unfortunately, some have simply assigned teachers to academies, creating resistance and thwarting curricular integration.

administrators, but where this does not happen, teachers in programs different from those they expected can flounder.[57]

Institutionalizing Reforms

Many innovative programs we have seen have been the creation of one or two individuals, who have then been able to motivate others with their vision of changing schools. The dark side of having change spearheaded by a few individuals is that reforms are critically dependent on them; if they leave for other positions, retire, or are fired in a dispute or a political battle with other administrators, then the change may dissipate. Many fledgling efforts to integrate vocational and academic education have fallen apart in precisely this way. The alternative to dependence on the vision of a single individual or a small group is to institutionalize change so that it is embedded in the structure, responsibilities, and culture of a school—so that it can outlive any particular individual.

There are several ways to institutionalize reform. One is to create institutional roles that extend the responsibilities for implementing changes to certain individuals. An example is the process of assigning academic teachers to work with vocational programs, as in the Smithville Area Vocational Center, or coordinators to work with both vocational and academic instructors, as in the Ohio Applied Academics program. This gives the prime responsibility for integration to interested individuals, rather than leaving it to the idiosyncrasies of other teachers who may not see this as their job. Another example has emerged at Landon High, where the principal has created several curriculum committees to give teachers more participation and a greater stake in the changes taking place there. A further approach to making reforms permanent is to embed changes in curricula, and then to incorporate these curricula into the regular program of the high school; thus, a potential advantage of curricula such as the applied academics courses is that, once accepted as courses meeting graduation requirements with teachers accustomed to teaching them, they are likely to persist. (This is particularly the case when courses are accepted for graduation credit or are required courses such as English and math.)

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[57] Adelman (1989) describes a science teacher at Dauphin County Tech who—even in a school with regular cluster meetings and mentor teachers—was teaching a conventional science sequence completely unconnected to the needs of his students in the service cluster.

A more complex form of institutionalization is to develop organizational structures like the traditional subject-area departments. The career paths of Landon High and the occupational cluster majors of Bennis Polytechnic are examples of administrative structures which foster the integration of vocational and academic education; once established, they are likely to continue even if the originators of these practices leave. Changing teacher training practices is another way to make reforms in teaching methods permanent, though one which is likely to take considerable time. Finally, changes can become institutionalized in school cultures: In a very few of the schools we have visited (e.g., Landon High, Bennis Polytechnic, and some of the single-occupation high schools) it has become accepted that vocational and academic teachers ought to work with one another, and this attitude toward teaching—reinforced by hiring only teachers who accept this notion—replaces the more common practice in which teachers are isolated from one another.

It is too soon in the effort to integrate vocational and academic education for there to have been much progress in institutionalizing reforms. Unless this takes place, however, there will be no permanent changes in educational practices—and then another generation of educators will find themselves addressing once again the question of how to integrate vocational and academic education.

THE PURPOSES OF INTEGRATION: RECONSTRUCTING THE AMERICAN HIGH SCHOOL

As we have seen, the approaches to integrating vocational and academic education vary considerably. Some require only that individual teachers change their courses in marginal ways; others involve cooperation among relatively few teachers—as few as two or three—while others include all faculty within a school. Some change individual courses at the margin; some add new courses to the crowded high school curriculum; and others reshape entire programs. Some are directed only at vocational students, while others focus on the general track or change the curriculum for all students. They also vary substantially in their intentions—partly in response to different ideas about what the most serious educational problems are. In addition, it is crucial to see integration as a dynamic process, in which a school might begin with one goal and then add additional elements, or further

modify its practices. In such cases, the purposes of serious reform efforts are shifting constantly.

Even the simplest of these reforms are worthwhile, in our view. Those that appear remedial or that replace worthless courses in the general track with applied academics courses can enhance learning as well as serving as first steps for subsequent changes. However, the most thorough reforms can be interpreted in much more ambitious terms—as efforts to reshape the American high school, to take some of its most serious failings, and to reconstruct the vision of what secondary education should be. In this section we outline our interpretation of what the efforts to integrate vocational and academic education offer, even in those high schools where existing vocational and academic programs seem to be functioning smoothly. These purposes turn out to have a natural symmetry: Some of them remake the vocational program; some provide new forms of career-oriented guidance; and some reform the high school for all students—vocational and academic—rather than changing only those aspects historically labeled vocational education.

Reforming Vocational Programs

Much of the impetus for integrating vocational and academic education has come from vocational educators, and—with the emphasis of federal funds under the 1990 Amendments to the Perkins Act—the majority of resources for integration are likely to come from the vocational side as well. It, therefore, seems natural that the first priority of many innovations has been to reform vocational programs. This goal has taken several different forms:

- *Remediation for vocational students*

  Some approaches to integration are efforts to improve the basic skills which elementary and middle-school teachers have failed to convey to vocational students. The practices in the first two models and the use of Applied Mathematics and Applied Communication as freestanding courses for vocational students are examples of remedial purposes. In addition, those academies that have focused on students at risk of dropping out are essentially dropout prevention programs, using the hook of occupational content to keep in school—and, therefore, to provide basic competencies to—students who might otherwise leave (even if they are not defined

as vocational students). In theory, these approaches to integration could teach relatively advanced academic competencies to vocational students; however, where efforts are closely tied to the requirements of relatively unskilled entry-level jobs or where students are viewed as being academically deficient, the academic content is likely to be basic or remedial.

- *Academic enrichment for vocational students*

  Some efforts at integration are primarily intended to increase the academic competencies of vocational students above those which now prevail and above those which can be considered basic. The development of geometry/drafting pairings to lure more students into geometry and additional math, the replacement of general science with Principles of Technology or other lab-based science courses, and the use of senior projects with extensive research and writing components are examples of practices intended to increase the rigor of vocational programs.

Of course, the boundary between remediation and academic enrichment in vocational programs is difficult to draw, partly because of traditionally low academic levels in many vocational programs. This distinction is likely to reflect intention as well as the level of academic content. Where the purpose of integration is to prepare students for relatively unskilled entry-level work after high school, remediation rather than academic enrichment is likely to be taking place. Those efforts at integration that have shifted to a newer conception of vocational education as a form of preparation either for employment or postsecondary education are more likely to enhance academic content to prepare students better for further study, often through 2+2 and other articulation mechanisms.

- *Innovative occupational programs*

  Some efforts at integration have taken seriously the common idea that many occupations now require higher-level skills, including math, science, and problem-solving, and they concentrate occupational preparation on those jobs requiring greater skills and enjoying greater status and earnings. Examples include high-tech and engineering-oriented magnet schools and academies; new courses such as materials science, aquaculture, laser technology, and biotechnology; collaboration between vocational teachers and math and science teachers; and senior projects that allow students to explore emerging areas and problems of their own devising.

While the subjects which have historically dominated vocational education—business, various trades, home economics, and agriculture in rural areas—still prevail in most secondary schools, the most innovative institutions have developed programs in quite different occupational areas, with the academic content appropriate for these emerging fields.

- *A new conception of vocational education*

One component of many reforms is a reconsideration of what vocational education should be, especially given declining enrollments caused by graduation requirements. The most ambitious efforts to integrate vocational and academic education provide a relatively clear—though controversial—image of vocational education. Consistently, these schools have abandoned job-specific skills for employment right after high school. Even the most sophisticated vocational programs—such as Bennis Tech with its programs that rival those of the surrounding community colleges—see their role more as fostering interest in broad occupational areas and providing the information and skills that will serve students well as occupations change in the future. As materials describing the Bennis program describe the goal, "All fields require lifelong learning. . . . Skills can become obsolete, but systems based on physical laws and basic technological processes cannot. A student who understands these systems has a basis on which to build new skills and to stay current as technology impacts various areas." Similarly, the programs designed around occupational clusters forego job-specific skill training; indeed, the principal at Landon High disagrees with the notion that any high school should provide job-specific skills "because employers told us that's not what they want." The Landon program also sees the role of an integrated curriculum as providing the capacities—both those historically viewed as academic and those considered more vocational—on which more job-specific further education can build. Many of these schools have established close links with community colleges and technical institutes in 2+2 or tech-prep programs, and they see postsecondary education as the appropriate place for job-specific skill training.

The occupational clusters or paths or majors which have been adopted in several innovative programs are themselves indications of abandoning job-specific training. Ideally, these programs present students with the broad concepts and technical principles underlying combinations of related occupations, and, thereby, force

teachers away from emphasizing job-specific skills and toward more general forms of education that are still clearly vocational.

In part, abandonment of job-specific training reflects what teachers and administrators see as the appropriate role of the high school, and represents a response to both the long-run interests of their students and what employers want. In part, however, this shift in attitude about vocational education reflects a harsh reality: In most schools, very few students find employment right after high school in occupations related to their field of vocational training. Consistently, vocational instructors responded to our questions about what graduates do by mentioning first the postsecondary programs they enter; most acknowledged that few go into related employment, mostly in relatively unskilled positions at entry-level wages—for example, students from drafting programs who might work as assistants (but not drafters) in architects' offices, or entry-level workers in auto body shops.[58] Teachers at Bennis Tech noted that most students change occupations four or five times before settling down, clarifying how pointless it would be to prepare them for particular jobs. These results are consistent with other findings about the effects of secondary vocational education: Relatively few students take coherent vocational programs and then find related employment.[59] In general, the labor market for eighteen-year-olds is one of low-skilled, low-wage work with few advancement opportunities (Osterman, 1980, 1989), a poor place to exercise the vocational skills that even a sophisticated vocational program could provide.

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[58] There are a few exceptions to our general conclusion that high school programs do not place students in related employment. Some area vocational schools in the Southeast, which provide half-day programs during two years and, therefore, provide substantial amounts of job-related vocational education, have established good working relationships with employers and appear to place a substantial fraction of their students in related employment. (This appeared to be the case for the Seward Area Vocational School, for example.) However, many of these placements are in low-wage positions; for example, industrial sewing programs prepare individuals for the textile industry, and cosmetology programs train substantial numbers of hairdressers. Thus, we are ambivalent about even these apparent "successes." The NCRVE is currently analyzing data from SREB sites which will provide some information—though still incomplete—on whether vocational graduates obtain employment related to their training.

[59] Roughly forty percent of students describing themselves as vocational students take three or more occupationally specific courses (Hoachlander & Choy, 1986). Rumberger and Daymont (1984) found that those completing vocational programs increased the likelihood of finding a job in a related field by twenty-five to thirty-eight percentage points over students not taking vocational education only in the areas of agriculture and office occupations (for men) and distributive education, health occupations, and office occupations (for women).

Assisting the Vocational Decisions of Students

The high school has become an inescapably vocational institution. When students are asked why they are in high school, the greatest number reply in vocational terms: to get a job and to get access to postsecondary education, which in turn leads to higher-status employment (National Association of Secondary School Principals, 1984). More generally, adolescence as a period when choices must be made about various aspects of identity, including one's vocational identity, coincides roughly with high school (Stern & Eichorn, 1989; Grubb, 1989). Unfortunately, most high school students appear to be unable to grapple adequately with the occupational choices they face and with the related educational decisions they inevitably make, either by direction or indirection. Many teachers and counselors we interviewed described students as adrift, unable to make plans. "They think high school will last forever," said several teachers in explaining their students' inability to grapple with the future; another perceptive teacher described them as "isolated"—from history, from their families, and from the world of work and adulthood in general. In this setting, the decisions students make about their futures—and about their schooling—are random, quixotic, and poorly informed. The only students exempt from this sorry state are the roughly one quarter bound for a four-year college—and they are exempt only because they will have another four to six years to grapple with their occupational identities. For the remaining three quarters of youths[60]—those who drop out before completing high school, those who go to work directly after high school, or those who enter a community college or technical institute unsure of their path—the consequences of uninformed choices are more immediate.

Many different social institutions and practices have failed these youths. For some, their parents provide little guidance; for the worst-off youths, their parents' contact with employment has been so episodic that it would be unfair to expect them to provide any direction to their children. American culture—the culture of television, movies, music, the consumer culture of advertising and shopping malls, even the "literate" teen culture of *Sassy* and *Seventeen*—focuses on consumption, not production, and its images of work and preparation for work are either absent or misleading. But the high school has failed,

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[60] About thirty percent of students entering high school leave before graduation. Of those graduating, about thirty-five percent enter four-year colleges, and another twenty percent of the nineteen percent who enter community colleges transfer to four year colleges. Roughly, then, thirty-nine percent of those entering college—but only twenty-seven percent of each student entering high school—will have the luxury of time that four-year colleges afford.

too. Career guidance has all but vanished from most high schools; counselors themselves are overworked, often poorly informed about options other than college, and preoccupied with scheduling, crises, and small numbers of exceedingly troublesome students. Most teachers—with the important exception of some vocational teachers—do not see their roles as providing career guidance, except in the general form of urging their students to do as well as they can.

In this vacuum, the innovative schools we have seen have tried to reconstruct the guidance and counseling function of the high school. Several states and localities have devised courses (such as Introduction to Technology) aimed at eighth or ninth graders, both to teach them about current production methods and to introduce them to various careers. Some schools have devised new procedures, usually in ninth or tenth grades, incorporating diagnostic inventories of student interests which counselors then use to focus the planning of students. Others have hired more counselors, found ways to relieve them of their responsibilities unrelated to career counseling, and instituted more sophisticated career centers. Perhaps most promising of all is the requirement that students in Landon High and Bennis Polytechnic make occupationally relevant school choices that have consequences. Choosing a career path or occupational cluster, living with the consequences of that choice for courses and activities, and then confirming or revising that choice forces students to grapple with possible occupations relatively early and often in ways that other forms of guidance and counseling cannot.

These changes are too new to be evaluated, and it is easy to be cynical about their effectiveness in a society with so much misinformation about occupations. But they have real promise, and the schools that have adopted them see the reconstruction of career guidance and counseling as central. Most obviously, guidance efforts can help integrate vocational and academic education by making sure students take coherent sequences of courses, and they can help students make better informed choices. More than that, they can help clarify to students why school is important. When students cannot picture their occupational futures and cannot comprehend what is necessary for successful employment, then they are unlikely to understand why their teachers are trying to hammer in the rudiments of reading, writing in different forms, math, or appropriate behavior. Even more for the academic curriculum than for vocational programs, providing young people with more sophisticated abilities to grapple with occupational alternatives could restore

some meaning to the high school, in place of the current situation where students attend for vocational reasons without understanding quite why.

Reforming the High School for All Students

The effort to integrate vocational and academic education has often been interpreted as a way of reforming vocational education alone. But in our view the greatest promise of this "movement" is that it can reshape the academic curriculum as well, and in the process shape a very different kind of high school. These efforts include the following:

- *Eliminating the "shopping mall high school"*
  The image of the high school as a shopping mall, where students "shop around" among courses taking whatever strikes their fancy and accumulating an incoherent program of unrelated courses (Powell, Farrar, & Cohen, 1985), is one that is both accurate and devastating. Many administrators and teachers we interviewed complained about this pattern. The tendency to "mill around" in the curriculum, related to the inability of students to formulate coherent occupational plans and to link school courses with those plans, may be especially serious for general-track and vocational students who don't have college entrance requirements to constrain them, but it describes almost all students to some extent. The shopping mall high school also has the potential to undermine well-intentioned reforms: Many novel courses of potential importance—including applied academics courses such as Principles of Technology and introductory courses such as Introduction to Technology—have been rendered meaningless by the tendency of some high schools to convert courses not required for graduation into unrelated electives.

  The most thorough efforts to integrate vocational and academic education have worked purposively to eliminate the "shopping mall high school" by establishing coherent programs that focus on clusters of occupations—the occupational specialties of the Academy Model, the career paths of Landon High, the occupational clusters of Bennis Tech, and the occupational cluster departments of Dunwood Tech and Dauphin County AVS, and the obvious occupational purposes of single-occupation high schools and magnet schools. Some of these programs are more restrictive than others: The courses associated with occupational

specialties in Bennis Tech leave almost no room for electives, while the career paths of Landon High present "suggested" courses to students without requiring them to take a specific sequences. But all of them concentrate on *programs*, rather than treating high school as a set of random courses studded with graduation requirements; all of them move from the incoherence of the shopping mall high school to the clear missions and institutional cultures of "focus schools" (Hill, Foster, & Gendler, 1990).

There are, of course, ways of devising coherent programs other than an emphasis on occupational clusters. Schools-within-schools or academies could be focused on social problems (e.g., those of the environment or of cities), or specific projects, as could magnet high schools; and some focus schools have concentrated on traditional academic subjects, such as science and math high schools. However, given the unavoidably vocational nature of the high school, an occupational focus for programs of study makes some sense: It helps students grapple with the variety of occupations they face; it presents them with opportunities for "trying out" different occupations in ways that are more meaningful than the usual career education course; it allows them to change their minds if they have decided an occupational area is not to their liking; and it enables teachers and students to integrate both vocational and academic material related to clusters of occupations.

- *Improving the teaching of all subjects*

In some schools that have integrated vocational and academic education, teaching methods have begun to change as academic teachers absorb teaching techniques that have always been more common in vocational classes. A greater reliance on cooperative learning (in which students work in small cooperative teams), on project-driven approaches and discovery methods, on student-directed activities and student participation rather than teacher-dominated classrooms, on learning in a specific context rather than decontextualized learning, and on the teaching of generic skills (Stasz, McArthur, Lewis, & Ramsey, 1990) has always been more common in vocational education than in academic instruction. Recently, an increasing number of teachers have begun to explore these approaches (especially cooperative learning), and cognitive scientists have proclaimed support for at least some of these methods. To be sure, changing teaching practices is a slow and difficult process, and we know very little about the advantages of particular approaches for

particular subjects and specific groups of students.[61] Still, the change to such teaching methods is more natural when vocational and academic content are integrated because the vocational setting provides the context and some obvious projects for student learning and because vocational teachers can provide examples of more active teaching. Curricular integration, therefore, has the potential to help change teaching methods in ways that would benefit all instruction.

- *Enhancing the engagement of students*

  One dispiriting feature of many high schools we visited is the disengagement of students—their inattention to teachers, classroom activities, and homework, and their lackadaisical attendance. In some classrooms, levels of inattention were so great that teachers had to spend absurd amounts of time to get students to follow simple instructions. In other cases, it appeared that students were learning only random fragments of what teachers were presenting because they drifted in and out of consciousness. There are surely many causes of such disengagement, including poor teaching, inadequate motivation from parents, aversion to homework, short attention spans fostered by television, the attractiveness of teen culture, the hormonal surges of adolescence, the anti-intellectualism of American culture, and the lack of any clear relationship (for the majority of adolescents) between behavior in school and later options. There is blame enough to go around.

  In the schools we visited, the most attentive students were in the best taught vocational courses and in the Advanced Placement classes—that is, in the best of both the vocational and the academic curricula. Several efforts at integration also had relatively attentive students, especially the applied academics classes in Ohio (even at 2:15 on a Friday afternoon); the student-centered and activity-based methods of vocational education are helpful in keeping students' attention. More generally, though, the effort to clarify the relationship between future occupations and present schoolwork promises to enhance student motivation as students come to understand that their high school activities influence their future options.

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[61] For a more extensive analysis of two different approaches to teaching—the dominant approach which we label "skills and drills" and a polar opposite we call "meaning-making"—see Grubb, Kalman, Castellano, Brown, and Bradby (1991). In general, academic instruction in high schools follows the approach of "skills and drills, while vocational instructors are more likely to use elements of "meaning-making"—though, there are certainly many vocational instructors, particularly in business and home economics, whose teaching methods are indistinguishable from the deadliest academic approaches.

Unfortunately, the problem of disengagement by itself can undermine any conceivable education reform: If students aren't paying attention, it doesn't matter what schools look like or how much time students spend in them. The efforts to integrate vocational and academic education provide some ways of enhancing the engagement of all pupils, in all courses, by beginning the process of changing how high school is taught.

- *Reducing the isolation of teachers*

  Some models of integrating vocational and academic education place a premium on cooperation between vocational and academic teachers. The various forms of curriculum "alignment," for example, require such collaboration, sometimes on a relatively small scale; the Academy Model, career paths, and occupational majors require other forms of working together, usually quite extensive. Given the historical isolation of vocational and academic teachers, these forms of cooperation are wonderful to see, and, in our view, they are much more promising ways of integrating vocational and academic education than the efforts which take curricula "off the shelf" without such cooperation.

  However, many teachers and administrators remark that even though the isolation between vocational and academic teachers might be profound it is quite similar to the isolation of all teachers—even within disciplines. One benefit of approaches such as the Academy Model, the career paths of Landon High, or the occupational majors at Bennis Tech is that they provide opportunities for academic teachers to work together, devising lessons that cut across disciplinary boundaries. The energy levels in schools with such forms of collaboration are palpable: Teachers seem more enthusiastic about what they are doing; they understand the connections among courses better; and there is a sense of a common enterprise in shaping the education of young people—in place of individual teachers in separate cells, each tending to one small part of each student's development.

- *Reducing tracking and segregation of students*

  Historically, the division between vocational and academic education has also been a division between college-bound and work-bound students, with vocational programs disproportionately drawing students of low academic performance and low socioeconomic status. However, when vocational courses become more

sophisticated, they become attractive to students who otherwise think of themselves as "academic" students. Conversely, when the occupational importance of academic courses is clarified, they become more attractive to students who might otherwise think of themselves as not bound for college. Some schools which have integrated vocational and academic education claim to have reduced the segregation of students into distinct vocational and academic groups—with the segregation by class, race, and ethnicity which always accompanies such tracking—even though they recognize that the change has not been great. Occupational clusters provide other ways of integrating students with different interests and ambitions, and the ancillary activities associated with clusters or career paths—field trips, talks from business representatives, internships, and the like—provide opportunities outside the usual course structure for mixing students who are usually segregated.

In general, conceiving of integrating vocational and academic education as the way to "de-track" students has been comparatively rare. Indeed, several innovations have simply replicated the divisions of the conventional high school: Some academies accept only "at risk" students, and other programs include only middle- and upper-ability students and shun those with any academic or behavior problems.[62] Administrators and counselors still use vocational education as a "dumping ground," even in schools that have made great strides in changing the content of vocational courses.

In our view, the internal segregation of the high school is one of its least lovely aspects, and merits more attention from school reformers than it has gotten so far. We are under no illusions that undoing this segregation will be simple; however, in this effort, certain approaches to integrating vocational and academic education have some obvious advantages.

- *Providing a vision of business participation*

  Partnerships between business and education have been all the rage during the 1980s, though their purposes are sometimes unclear. Some are ways for schools to get additional resources from businesses as philanthropists; others represent forums for employers to preach the doctrine of free enterprise to a captive audience; some

[62] Some of the success of Bennis Polytechnic and of Dunwood Tech stems from their selectivity and the knowledge that students who misbehave can be dismissed to other high schools.

are exercises in public relations in which businesses can pretend they are helping in a socially useful cause and educators can pretend they are reaching out to their clients. No doubt many partnerships have been useful, but many more have been unfocused and trivial.

However, some efforts to integrate vocational and academic education have included business in specific ways, and they offer an image of how business might participate in the reconstruction of the high school. In the academies and various other schools, businesses play an important role in motivation: In addition to extrinsic rewards such as summer jobs and future employment, they reinforce the importance of learning both technical and academic competencies, and business people can offer testimony—testimony that educators cannot provide—that what young people learn in school is used in other settings. In this relationship, high schools and firms are partners in a specific sense, with particular responsibilities for each.

Integrating vocational and academic education is not necessarily an end in itself. Instead, it provides a vision of education and a way of overcoming some deficiencies of the American high school, including those that developed from the original division between vocational and academic subjects and between college-bound students and those bound for work. Some crucial elements of the models we have examined don't have much to do with integrating vocational and academic education: Smaller class sizes, improved counseling, coherent programs of courses, the smaller scale and continuous contact between teachers and students in academies and occupational clusters, teachers who collaborate in developing curriculum and taking responsibility for students, and closer connections to institutions such as firms outside the schools are all improvements that schools could undertake even if they have no interest whatsoever in vocational education or in the vocational purposes of education.

However, even if integrating vocational and academic education is an intermediate goal, it provides an impetus for changes that otherwise would not take place. In attempting to integrate different subjects, teachers are forced to collaborate and to confront the deficiencies of the traditional academic teaching style and the liabilities of oversized classes. In developing coherent programs, educators must come to some decisions about what a coherent curriculum means, how students can learn to make intelligent choices, and what

the connection is between the school and the rest of the society in which it is embedded. Above all, the efforts to integrate vocational and academic education force us all to recognize the varied capacities—general and specific, "academic" and "vocational," manipulative and behavioral as well as cognitive—that successful individuals must possess. For these reasons, the effort to integrate vocational and academic education may be the best stimulus to reconstruct the American high school.

Appendix A

SCHOOL VISITS AND INTERVIEWS

Appendix A

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We began our search for efforts to integrate vocational and academic education by ransacking the literature, canvassing our colleagues in both vocational and academic education, sending out appeals through electronic networks, responding to rumors of state pilot projects and local reforms, and exploiting existing networks of educators.[63] We quickly determined that both verbal and published descriptions of innovations were difficult to use (with the exception of Adelman, 1988); they were typically vague about what changes had taken place and how classroom practices (as distinct from rhetoric about practices) have been modified.[64] We, therefore, visited a large number of schools, listed in Appendix A. Typically, one to two individuals visited each school for one to two days; the majority of our visits involved two person-days, though some were as short as a single day and others involved four person-days. We interviewed the administrators or heads of integration efforts, other teachers associated with the reform, counselors, and school principals (if they were not the administrators of the program); we observed in classes, particularly those that were the most affected by the reform, and interviewed the teachers whose classes we observed. Classroom observations were crucial, because they indicate ways in which classrooms practices diverge from the official rhetoric and purpose. We did not speak extensively with students, and, therefore, this examination is primarily an educator's view of school changes, rather than a view from the eyes of students. Though our visits were relatively brief, they often exhausted the information available about the

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[63] Our efforts included the usual search of ERIC, and an appeal through the ADVOCNET electronic mail system of the National Network for Curriculum Coordination in Vocational and Technical Education. The survey of state directors of program improvement by Losh, Border, and Bishop (1988) was helpful in identifying states which had undertaken initiatives of their own. Larry McClure and Tom Owens of the Northwest Regional Educational Laboratory's Education and Work Program were helpful in identifying programs in the Northwest; the Lab also publishes a newsletter—"Applied Academics Exchange"—for those schools working on integration. The National Center has been working extensively with the consortium of schools in the Southeast organized by Gene Bottoms of the Southern Regional Education Board (SREB), providing us access to these schools. The American Vocational Association has been trying to identify vocational programs incorporating basic skills, but an ad in the American Vocational Association's *Update* yielded very few responses. Nancy Adelman of Policy Studies Associates, who conducted her own search for research sponsored by the National Assessment of Vocational Education (Adelman, 1988), provided other helpful leads. However, our search for efforts to integrate vocational and academic education is surely incomplete, and we would welcome hearing from those who have been involved in other efforts.

[64] For a review of the available literature, again concluding that most published reports are too general to understand the approach to integration being tried, see Plihal (1990).

nature of integration efforts except for the kind of ethnographic information that requires weeks of observation—a luxury we did not have.

Schools Visited

Alabama

Muscle Shoals Area Vocational Center, Muscle Shoals (SREB)

Arkansas

Jonesboro Area Vocational High School, Jonesboro (SREB)
Jonesboro High School, Jonesboro

California

Academy of Finance, Downtown Business Magnet, Los Angeles High School
Academy of Science and Technology, Irvine Unified School District, Irvine
Health Academy, Oakland High School, Oakland
Pre-Engineering Academy, Oakland High School, Oakland
Business Academy, McClymonds High School, Oakland
Business Administration Magnet School and Computer Academy, Crawford High School, San Diego
Kearney High School, San Diego
Health Professions Magnet, Lincoln High School, San Diego
Computer Academy, Menlo-Atherton High School, Menlo Park
Duncan Polytechnical High School, Fresno
Electronics Academy, Sequoia High School, Redwood City
Royal High School, Simi Valley
Woodland High School, Woodland

Florida

Lake Gibson High School, Lakeland (SREB)
Palm Beach Gardens High School, Palm Beach (SREB)

Georgia

Cedartown High School, Cedartown (SREB)

Oakland Vocational Center, Gwinnett County School System (SREB)
Meadowcreek High School, Gwinnett County School System (SREB)

Illinois

Bowen High School, Chicago
Chicago High School of Agriculture, Chicago
Curie High School, Chicago
Westinghouse High School, Chicago

Kentucky

Fairdale High School, Louisville (SREB)

Maryland

Blair Magnet Program, Montgomery-Blair High School, Montgomery County

Michigan

Calhoun Area Vocational Center, Battle Creek
Tekonsha High School, Tekonsha
Battle Creek Central High School, Battle Creek
Lakeview High School, Lakeview

Mississippi

Pontotoc Ridge Area Vocational Center, Pontotoc (SREB)

North Carolina

Richmond High School, Hamlet

Ohio

Western Hills School, Cincinnati
Live Oaks Joint Vocational School, Cincinnati
Montgomery County Joint Vocational School, Dayton
Pioneer Joint Vocational School, Shelby
W.E. Stebbins High School, Dayton
Green County Career Center, Xenia
Warren County Career Center, Lebanon

Oregon

Benson Polytechnic High School, Portland
Churchill High School, Eugene
Springfield High School, Springfield
Corvallis High School, Corvallis
Cottage Grove High School, Cottage Grove
Crescent Valley High School, Corvallis
Lebanon Union High School, Lebanon
South Albany High School, Albany
Linn Benton Community College
Sheldon High School, Eugene
Thurston High School, Springfield
West Albany High School, Albany

Pennsylvania

Business Academy, Strawberry Mansions High School, Philadelphia
Health Academy, Martin Luther King High School, Philadelphia

South Carolina

Cherokee County Area Vocational School, Gaffney (SREB)
Fred Hamilton Career Center, Oconee County (SREB)
Gaffney High School, Gaffney (SREB)
Walhalla High School, Walhalla (SREB)
West Oak High School, West Oak (SREB)

Tennessee

Humphreys County Vocational Center, Waverly (SREB)

Texas

High School for Health Professions, Houston
Skyline High School, Dallas

Washington

Juanita High School, Kirkland

Lake Washington High School, Kirkland
Lake Washington Vocational-Technical Institute, Kirkland
North Thurston High School, Lacey
Sammamish High School, Bellevue
Timberline High School, Lacey
Woodinville High School, Northshore

West Virginia

Randolph County Vocational Technical Center, Elkins (SREB)

Note: Sites affiliated with the Southern Regional Education Board consortium are denoted by SREB.

Telephone and Personal Interviews

Jefferson Adams, Superintendent, Kent County Vocational Technical District, Delaware
Jim Allison, Director, Division of Career-Vocational Education, California
Dick Baker, Gladstone High School, Gladstone, Oregon
Dan Barnum, Sheldon High School, Sheldon, Oregon
Kevin Carson, Assistant Superintendent, Sussex County Vocational Technical School District, Delaware
Marv Clemons, Regional Vocational and Career Education Coordinator, Eugene, Oregon
J.E. Cogswell, Executive Director, Occupational Education, Dallas Public Schools
George Frunzi, Superintendent, Sussex County Vocational Technical School District, Delaware
Roger Hanson, Coeur d'Alene High School, Idaho
Keith Kerschner, Research for Better Schools, Philadelphia
Dennis Loftus, Superintendent, New Castle Vocational Technical School District, Delaware
Al Miller, Hillsboro High School, Hillsboro, Oregon
Lally O'Brien, Delone, Kahn, and Associates, Consultant to the Committee to Support Philadelphia Public Schools

Peggy Olivier, Pilot Project Coordinator, Special Needs Unit, Division of Career-Vocational Education, California State Department of Education

Sam Pambrun, Umatilla-Morrow Regional Planning Consortium, Pendleton, Oregon

Elizabeth Radcliffe, Consultant to the State Board of Vocational Education, Idaho

James Reed, Principal, Weiser High School, Idaho

Carol Schreffler, Assistant Principal, Sussex County Vocational Technical Center, Delaware

Robert Sommers, Consultant for Applied Academics, Division of Vocational and Career Education, Ohio State Department of Education

Ann Stephens, State Board of Vocational Education, Idaho

Gary Thompson, Program Manager, Business Education, Division of Career-Vocational Education, California State Department of Education

Harry Tobin, Director, Bureau of Industrial Technology Education, Chicago Public Schools

Nancy Verburg, State Department of Education, South Carolina

Judith Vogel, Balboa High School, San Francisco

Thomas Welch, State Director for Vocational Education, Delaware

Appendix B

CURRICULUM MATERIALS RELATED TO THE INTEGRATION OF VOCATIONAL AND ACADEMIC EDUCATION

Appendix B

CURRICULUM MATERIALS RELATED TO THE INTEGRATION OF VOCATIONAL AND ACADEMIC EDUCATION*

Applied Academics Courses

Principles of Technology, developed by the Center for Occupational Research and Development (CORD), Waco, Texas, in cooperation with the Agency for Instructional Technology (AIT), Bloomington, Indiana, and a consortium of state education agencies.

Applied Communication (AIT).

Applied Mathematics (CORD).

Basic and Academic Skills

ACTIVE: Academic Competency Taught in Vocational Education, State Department of Vocational Education, Lansing, Michigan (undated).

Applied Basic Skills Series, University of Texas at Austin, Division of Continuing Education, Extension Instruction and Materials Center.

Vivian Caldwell et al., *Language Arts* (1988).

Cam O'Keefe and Alan Towler, *Mathematics* (1988).

Steve Fuller and Alan Towler, *Science* (1988).

Alan Towler, *Interfacing Math, Science, and Technology*, University of Texas at Austin, Division of Continuing Education, Extension Instruction and Materials Center (1987).

L. A. Grimes, Jr., *Integrating the Basic Skills into the ICC (Industrial Core Curriculum)*, University of Texas at Austin, Division of Continuing Education, Extension Instruction and Materials Center (1987).

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* This list of curriculum materials is not a recommendation or endorsement of any of them, but is simply a

Donald Maley, *The Integration of Mathematics and Science into Technology Education: A Holistic Approach to Education*, University of Texas at Austin, Division of Continuing Education, Extension Instruction and Materials Center (undated).

Basic Skills in Consumer and Homemaking Education, State of New Jersey, Department of Education, Division of Vocational Education and Department of Home Economics, Glassboro State College, Glassboro, N.J. Lois Winand, project director; Vivian Gunn Morris, project coordinator; Jocelyn Walton, mathematics specialist; Kathleen Conroy, writing specialist; Nicholas Diobilda, reading specialist.

Mathematics in Consumer and Homemaking Education Programs: A Guide for Reinforcing Basic Skills (1987).

Reading in Consumer and Homemaking Education Programs: A Guide for Reinforcing Basic Skills (1987).

Writing in Consumer and Homemaking Education Programs: A Guide for Reinforcing Basic Skills (1987).

Basic Skills Improvement: A Handbook for Reading, Math, Writing, and Oral Communication, Barbara Dougherty and Jan Novak, project directors, and Judy Rodenstein and Keith Ruzicka, contributors, University of Wisconsin at Madison, School of Education, Vocational Studies Center (1986).

Barbara Nemko, *Model General Occupational/Employability Skills*, University of California at Davis, Department of Applied Behavioral Sciences (March 1986).

Building Basic Skills, available from the Center on Education and Training for Employment, Columbus, Ohio:

Thomas Long, *Basic Mathematics Skills and Vocational Education* (1980).

L. Jay Thornton, *Basic Reading Skills and Vocational Education* (1980).

Thomas Sticht and Larry Mikulecky, *Job-Related Basic Skills: Cases and Conclusions* (1984).

Lucille Campbell-Thrane et al., *Building Basic Skills: Models for Implementation* (1983).

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listing of those we have examined. We have made no attempt to make this list comprehensive.

James Weber and Cindy Silvani-Lacey, *Building Basic Skills: The Dropout* (1983).
Linda Lotto, *Building Basic Skills: Results from Vocational Education* (1983).

BASICS: Bridging Vocational and Academic Skills, available from the Center on Education and Training for Employment, Columbus, Ohio:

The Bridger's Guide (1987).
Instructional Program Development (1987).
Targeted Teaching Techniques (1987).

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Diversified Technology: A Technical Literacy Course for Students Pursuing "High Tech" Careers, Bureau of Vocational-Technical Education, Mississippi State Department of Education and Research and Curriculum, Unit for Vocational-Technical Education, Mississippi State University.

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